

# Final Program

## Thirty-Seventh Annual Meeting

### International Neuropsychological Society

February 11-14, 2009  
Atlanta, Georgia, USA

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#### WEDNESDAY, FEBRUARY 11, 2009

9:00 AM–12:00 PM

**Wednesday Morning Continuing Education Courses**  
Refer to CE schedule for location

1:00–4:00 PM

**Wednesday Afternoon Continuing Education Courses**  
Refer to CE schedule for location

5:00–6:30 PM

**Symposium 1: Development of the NIH Toolbox for the Assessment of Neurological and Behavioral Function: Implications for the Clinical Neuropsychologist**  
**Chair: David Tulsy, Discussant: Ida Sue Baron, Discussant: Gordon Chelune**  
**Marquis Ballroom A**

1. WEINTRAUB, S
2. TULSKY, DS
3. BAUER, PJ
4. CARLOZZI, NE
5. BOROSH, B
6. WEINTRAUB, S

Development of the NIH Toolbox for the Assessment of Neurological and Behavioral Function: Implications for the Clinical Neuropsychologist.  
The NIH Toolbox For the Assessment of Neurological and Behavioral Function: Development of standardized measures in NIH-Funded research.  
The Imitation Based Assessment of Memory.  
Processing speed and working memory task development: The NIH Toolbox project.  
Executive Functioning and Language Task Development: The NIH Toolbox Project.  
The Future of the NIH Toolbox for the Assessment of Neurological and Behavioral Function: Implications for the Clinical Neuropsychologist.

5:00–6:30 PM

**Symposium 2: Motor Imagery: a Rehabilitation Tool and its Neurophysiology**  
**Chair: Thamar Bovend'Eerdt, Discussant: Janet Cockburn**  
**Marquis Ballroom B**

1. BOVEND'EERDT, T
2. SCHUSTER, C
3. BOVEND'EERDT, T
4. DAWES, H
5. SHARMA, N

Motor Imagery: a Rehabilitation Tool and its Neurophysiology.  
Comparison of Motor Imagery Techniques Described in Psychology and Medical Literature Regarding their Practical Applicability.  
Development of a Motor Imagery Protocol for Neurological Rehabilitation Based on a Conceptual Framework.  
Primary Motor Cortex Oxygenation Changes during Overt and Imagined Movements using Near Infrared Spectroscopy.  
How do the Neural Networks during Motor Imagery (MI) Relate to those during Executed Movement (EM): a Multivariate fMRI Analysis.

5:00–6:30 PM

**Paper Session 1: Language**  
**Marquis Ballroom C**

1. ROELTGEN, DP
2. BREIER, JI
3. DULAY, MF
4. REILLY, J
5. TLUSTOS, SJ

Application of The Frith Model to Acquired Alexia and Agraphia.  
Changes in Language-Specific Brain Activation and Response to Aphasia Therapy Using MEG.  
Semantic Knowledge Loss After Surgery For Adulthood Onset Intractable Epilepsy.  
Sound Symbolism as a Window into Crossmodal Perception and Language.  
Developmental Differences in Comprehension of Degraded Speech: A Brain Imaging Study.

**5:00–6:30 PM****Paper Session 2: Traumatic Brain Injury (Adult)  
Marquis Ballroom D**

- |    |                   |   |
|----|-------------------|---|
| 1. | GIBSON-BEVERLY, G | Cognitive status at one-month post injury is the best predictor of productivity relative to other severity indices after TBI. |
| 2. | LABBE, D          | Factors predicting return to driving following traumatic brain injury.  |
| 3. | ETTENHOFER, ML    | Predictors of Long-Term Post-Concussive Symptoms in a University Population.  |
| 4. | BREWSTER, P       | Executive Function, Depression/Anxiety and Return to Work in Mild TBI: Does Gender Play a Role?                               |
| 5. | SULLIVAN, C       | Do Periodic Follow-up Evaluations Improve Long-Term Functional Outcomes after Traumatic Brain Injury (TBI)?                   |

**5:00–6:30 PM****Poster Session 1: Aging, Cross Cultural, HIV/AIDS  
Imperial Ballroom****ADHD/Attentional Functions**

- |    |               |   |
|----|---------------|---|
| 1. | RABINOVITZ, B | Motor Control Difficulties are Associated with Inattention but not Hyperactivity/Impulsivity in Preschoolers with ADHD. |
|----|---------------|---|

**Aging**

- |     |                   |  |
|-----|-------------------|--|
| 2.  | AUSTIN, AL        | Anxiety, Depression and Specific Cognitive Domains: The Use of Brief Screening Measures to Assess a Community Dwelling Aging Sample.               |
| 3.  | BAILIE, JM        | The Utility of the Montreal Cognitive Assessment (MoCA) in Detecting Confounding Cognitive Impairments in Studies of Abnormal Aging and Olfaction. |
| 4.  | BINEY, FO         | Hypertension Risk and Sympathetic Nervous System Reactivity.   |
| 5.  | BUIZA, C          | Age Relates Accurately To Reported Estimation Of Memory Abilities.   |
| 6.  | CHARLTON, RA      | Decline of Theory of Mind in Normal Ageing and the Relationship to Other Cognitive Functions and Brain Changes.                                    |
| 7.  | CHOU, W           | Context-Induced False Recognition in Normal Elderly Individuals.   |
| 8.  | COHEN, M          | * Dedifferentiation of Function in Older Adults During Category Member Generation.   |
| 9.  | DAVIS, HP         | Age Effects on Emotion Recognition in Facial Displays: From 5 to 89 Years of Age.  |
| 10. | DAVIS, HP         | Mediation Analysis of Tower of Hanoi Learning across the Lifespan: From 5-89 Years of Age.   |
| 11. | EDMONDS, EC       | * Cognitive Mechanisms of False Facial Recognition in Older Adults.  |
| 12. | FISCHER, BL       | Semantic Fluency Patterns of Clustering and Switching in a Community Dwelling Population of Older Adults.  |
| 13. | GIDLEY LARSON, JC | The Affect of Gender on Practice in the Elderly.   |
| 14. | GLASS, L          | Contributions of Working Memory and Processing Speed to Age-related Declines of Fluid Intelligence in a Clinical Sample.                           |
| 15. | GOLDIN, Y         | Gender Effects on Attention Networks in Aging.   |
| 16. | GRANT, R          | Rey-O Organization Strategy and Cognitive Impairment Among Older Adults.   |
| 17. | GUIDOTTI, L       | Age-related Temporal Gradient of Famous Names: A Semantic Priming Study.   |
| 18. | HAASE, L          | fMRI activation and olfactory cross-modal recognition memory performance in older adults.  |
| 19. | HIRSHSON, CI      | Gender Differences in Neuropsychological Test Performance in Non-Demented Older Adults.  |
| 20. | HOLLEY, KL        | Cognitive Status in Elderly Patients after Elective Joint Replacement.   |
| 21. | HORNING, SM       | Emotion Recognition across the Lifespan: Age and Sex Differences.  |
| 22. | JAK, AJ           | * Impact of Exercise on Hippocampal Volumes in Mild Cognitive Impairment.  |
| 23. | JONSDOTTIR, MK    | Age Gene/Environment Susceptibility (AGES)-Reykjavik study: Factor analysis of a neuropsychological battery in an epidemiological study of aging.  |
| 24. | KING, EG          | Aging and Longitudinal Changes in Virtual Morris Water Maze Performance.   |
| 25. | KOESTNER, BP      | Difficult Decisions: Ambiguous Decision-Making Versus Risk Decision-Making in Older Adults.  |
| 26. | KRASEAN, L        | Gender and Ethnic Group Differences in Neuropsychological Test Performance in an Urban, Older Adult Population.                                    |
| 27. | KUBIK, JL         | The Impact of Health Status on Everyday Problem Solving in Older Adults.   |
| 28. | LEE, GJ           | The Longitudinal Effect of Hormone Replacement Therapy on the Cognitive Functioning of Healthy Postmenopausal Women.                               |
| 29. | LEE, GJ           | The Longitudinal Effect of Hormone Replacement Therapy on the Cognitive Functioning of Healthy Postmenopausal Women with the APOE-4 Genotype.      |
| 30. | LERITZ, EC        | * Variation in Blood Pressure is Associated with Brain Structure and Cognition in African Americans.   |
| 31. | LOWE, DA          | AMNART's Utility as a Premorbid Estimate Among Older Adults.   |
| 32. | LOWE, DA          | Do the Features of Depression Change with Advancing Age?   |
| 33. | LY, JJ            | Influences of Age, Task Demands, and Practice on Attentional Capacity.   |
| 34. | MACKIN, S         | The Impact of Mild Cognitive Impairments on Physical Activities in the Elderly.  |
| 35. | MAY, PE           | Examining Albumin, Hemoglobin, and BMI as Predictors of Cognitive Impairment in Octogenarians and Centenarians.                                    |
| 36. | MILLER, LS        | Cognitive Capacity in the Oldest Old.  |
| 37. | MITCHELL, MB      | Functional Status in Centenarians and Octogenarians: Subjective versus Objective Measures.   |
| 38. | MUNRO, CA         | Sex Differences in Cognitive Test Performance Persist into Old Age.  |
| 39. | NGUYEN, CM        | Personality Characteristics Associated with Poor Decision-Making in Normal Elderly.  |

40. O'CONNOR, MK  
 41. O'MAHAR, K  
 42. POLLARD, K  
 43. RAMCHANDRAN, K  
 44. RASKIN, S  
 45. REED, B  
 46. RICHARDSON, EE  
 47. RISHER, EL  
 48. ROGALSKI, Y  
 49. ROGERS, SA  
 50. SHIVAPOUR, SK  
 51. SHUMAN, MJ  
 52. VAKIL, E
53. VALLESI, A  
 54. VANCE, DE
55. VANDERHILL, S  
 56. WESTHAFFER, JG  
 57. WILLIAMS, BR  
 58. YEUNG, S  
 59. ZIMMERMAN, ME
60. BOXER, O  
 61. STAVRO, G
62. CAGIGAS, XE  
 63. FUNES, CM  
 64. GUPTA, S  
 65. MARQUEZ DE LA PLATA, CD  
 66. SAEZ, P
67. SANDOVAL, T  
 68. SCHRETLEN, DJ
69. SHANAHAN, M  
 70. SUAREZ, PA
71. VERNEY, SP
72. HOLCOMB, E
73. GOULD, F  
 74. IUDICELLO, JE  
 75. POSADA, C  
 76. ROBBINS, RN  
 77. SCOTT, J
78. TATE, DF
79. VANCE, DE
80. WARDLE, M
81. WOODS, SP
82. DE MARTINO, MM
83. FOSTER, PS  
 84. KAKOS, LS
- Aging and memory: The effects of a multi-component intervention.  
 RBANS Patterns of Performance as Predictors of Cognitive Decline.  
 Predicting Cognitive Status in Older Adults Using Buschke, Age, and Cognitive Reserve.  
 Emotional Intelligence Predicts Older Adult Decision-Making Ability.  
 Prospective Memory and Medication Adherence Performance Across Three Age Groups.  
 \* Heterogeneous Trajectories of Cognitive Decline in Older Adults: Relationships to Neuropathology.  
 C-Reactive Protein, Homocysteine and Cognitive Functioning in Centenarians.  
 The Impact of Gender and Cognitive Impairment on Visuospatial Performance.  
 Effects of Contextual Information on Naming in Older Adults.  
 Organizational Strategy and Cognitive Impairment Among Older Adults.  
 Age-Related Changes in Financial Decision Making.  
 Learning and Cognitive Fatigue Effects on Attention Networks in Aging.  
 Probing the brain substrates of cognitive processes responsible for context effects on recognition memory.  
 \* Electrophysiological Evidence of Age-related Differences in Processing Task-Irrelevant Material.  
 Does Memory, Reasoning, and Speed of Processing Affect Falling among Community-Dwelling Older Adults?  
 Self-Reported Cognitive Inconsistency in Older Adults is Related to Memory Decline.  
 Aging, Cognitive Reserve and Cognitive Performance.  
 Are Older Adults More Susceptible to Retroactive Interference on the CVLT-II Than Young Adults?  
 Systolic Blood Pressure as a Predictor of Everyday Problem Solving in Older Women.  
 Sleep and Neuropsychological Functions in Nondemented Older Adults.
- Cognitive Neuroscience**
- Schizotypy and Lifetime Creative Achievement in a Large Healthy Adult Sample.  
 Cognitive and Personality Predictors of Creative Achievement.
- Cross Cultural**
- Cultural determinants of explicit and implicit category learning.  
 The Color Trails Test: More Culture-Fair than the Trail Making Test?  
 Investigation of Failed Hiscock Digit Memory Test Performance in Adults in Rural China.  
 A Cross-Cultural Investigation of Three Spanish Naming Tests.  
 The Relationship Between Acculturation and Nonverbal Neuropsychological Test Performance Among Hispanic Epilepsy Patients.  
 Aging Effects on Cross-Language Intrusions: Why Octopus Slips into Animales.  
 Do Performance Differences on the Trail Making Test and Brief Test of Attention in Spain vs. the USA Reflect Culture or Neurology?  
 Comparing Neuropsychological Profiles of ADHD Across Ethnicities: Implications for Validity.  
 English fluency predicts neuropsychological performance in Spanish among Spanish-speakers of Mexican descent.  
 Differential Predictive Validity of the WAIS-III with Reading Achievement in Ethnically Diverse Students.
- Forensic Neuropsychology**
- The Relationship Between Creativity And Laterality As Examined Through A Semantic Priming Paradigm.
- HIV/AIDS/Infectious Disease**
- The Cognitive Processes Subserving the Serial Reaction Time Task in HIV+ Women.  
 Risky Decision Making in Adults with HCV Infection.  
 Sustained Attention is Impaired Among HIV Infected Individuals with Bipolar Disorder.  
 Neuropsychological and Cultural Predictors of Adherence Among HIV+ Latinos.  
 Combined Effects of HIV and Aging: Is the Neuropsychological Profile Similar to Alzheimer's Disease?  
 12-Month History of Plasma CD4 Counts is Predictive of Attention and Executive Function Performance for HIV-Infected Patients.  
 A Comparison of Cognitive and Everyday Functioning in Younger and Older Adults with and without HIV.  
 Neurocognitive Functioning and Depression Interact to Predict Risky Sexual Behaviors in HIV+ Substance Dependent Individuals.  
 HIV-associated Prospective Memory Impairment in the Laboratory Predicts Real-World Failures to Execute a Future Intention.
- Other**
- EMOTIONAL STATES AND QUALITY OF SLEEP AMONG NURSES WORKING ON ROTATIONAL SHIFTS IN A EUROPEAN HOSPITAL.  
 Creativity and Sleep Disturbance.  
 Ghrelin is Associated with Cognitive Function, Fitness, and Appetite in Healthy Older Adults.

6:45–7:15 PM

**Award Ceremony**  
**Marquis Ballroom B**

7:15–8:15 PM

**Wednesday Evening Reception**  
**Marquis Foyer**

## THURSDAY, FEBRUARY 12, 2009

7:20–8:50 AM

**Thursday Morning Continuing Education Seminars**  
**Refer to CE schedule for location**

9:00–10:30 AM

**Paper Session 3: Normal Aging**  
**Marquis Ballroom A**

1. MENCHOLA, M
2. CHARLTON, RA
3. LAMAR, M
4. WILLIS, SL
5. VANNORSALL, TD

Multivariate Network of Mri Gray Matter Associated with Healthy Cognitive Aging.  
 Changes in Cognitive Abilities and MRI in Normal Aging After a Two-Year Delay.  
 Acute Tryptophan Depletion Promotes an Anterior-Posterior fMRI Activation Shift in Aging During Tasks of Cognitive Control.  
 Association of Midlife Cognitive Decline and Brain Volume.  
 White and Grey Matter Correlates of Processing Speed in Healthy Adults.

9:00–10:00 AM

**Invited Plenary: Individual and Species Differences in the Control of Attention**  
**Speaker: David Washburn**  
**Marquis Ballroom B**

1. WASHBURN, DA

Individual and Species Differences in the Control of Attention.

9:00–10:30 AM

**Symposium 3: Exploring Applications of Cognitive Efficiency in Children and Adults with Mild TBI.**  
**Chair: Gerard Gioia, Discussant: Caroline Roncadin**  
**Marquis Ballroom C**

1. GIOIA, GA
2. LOVELL, M
3. VAUGHAN, C
4. ISQUITH, P
5. RONCADIN, C

Exploring applications of cognitive efficiency in children and adults with mild TBI.  
 Cognitive efficiency in adult athletes with concussion.  
 Examining Two Methods of Cognitive Efficiency Following Mild TBI in the Developing Child.  
 Cognitive efficiency in children in working memory with typical and mTBI children.  
 Performance efficiency in working memory and inhibitory control tasks in children who sustained a mild closed head injury.

9:00–10:30 AM

**Poster Session 2: Memory, Psychopathology/Neuropsychiatry, Drugs/Toxins**  
**Imperial Ballroom**

### Assessment/Psychometrics/Methods (Adult)

1. TREWORGY, S
2. CHERNER, M
3. ENGLE, J
4. FORTIER, CB
5. GONZALEZ, R
6. HSU, Y
7. MORGANO, J
8. SORG, S
9. SQUEGLIA, LM
10. SULLIVAN, K

Neurological Assessments Which Best Predict Cognitive Status in Older Adults in Association with Age and Cognitive Reserve.

### Drug/Toxin-Related Disorders (Including Alcoholism)

Length of Abstinence is Unrelated to Neuropsychological Performance in Methamphetamine Dependent Adults.  
 Probabilistic Reinforcement Learning in Children with Fetal Alcohol Spectrum Disorder (FASD).  
 Associative Learning and MRI Correlates in Abstinent Alcoholics and Normal Participants.  
 Neurocognitive Disinhibition and Cannabis Addiction: a Pilot Study.  
 Midazolam-Induced Cognitive Impairments and Treatment Effects of Flumazenil in Day-Case Colonoscopy Patients.  
 Neuropsychological Effects of Lead Poisoning on Behavior.  
 Reduced White Matter Integrity in the Genu of Alcoholics and its Relationship to Processing Speed and Age.  
 Can Neuropsychological Assessment Predict Future Drinking in Adolescents?  
 Neuropsychological Functioning in Military Pesticide Applicators from Gulf War I.

**Memory Functions**

11. ALBERTS, JW The Role Of A Dual Activation-Inhibition Process In Both False And Accurate Retrieval Of Information From Memory.
12. ALBERTS, JW Does Age-related Susceptibility To False Memories Account For Developmental Differences In Rates of False Memories?
13. BLOCK, CK Perception of Memory Complaints and Effort on Memory Performance.
14. BRAND, JG The Lateralizing Value of Rey-Osterrieth Complex Figure Test Item Eleven.
15. BRICENO, EM The Relationship of Depression Symptoms to Spatial Navigation Performance Across the Lifespan.
16. CHAN, RC The development of prospective memory in typically developing children.
17. CONSIDINE, CM Memory Task Performance and Dissimulation among Patients with Major Depressive Disorder.
18. DEBASTOS, A The Role of Semantic Clustering in Verbal Learning (CVLT-C) Is Age Dependent.
19. DIAMOND, BJ Impact of Load, Operations and Fatigue on Processing Speed Using Novel Accuracy Selectable Programs.
20. FOSTER, PS Spreading Activation in Nonverbal Memory Networks.
21. GOKCAY, D- Emotional stimuli based exclusively on valence fail to enhance recognition memory: A study across ages.
22. HAMPSTEAD, BM Assessment of 3-Dimensional Shape Recognition as a Novel Visuospatial Memory Test.
23. HAN, S Effects of Repetition and Encoding Strategy on Face-Name Recognition Memory.
24. HILL, BD Are Two Factors Better Than One? Examining the Validity of Combining Forward and Backward Digit Spans.
25. KESSELS, RP Hippocampal involvement in associative working memory: Evidence from fMRI.
26. LANCASTER, MA Attributes of Famous Face Recognition Speed.
27. MENDOZA GONZÁLEZ, E The Prospective and Retrospective Memory Questionnaire (PRMQ): Psychometric Properties of Spanish Version.
28. MITCHELL, EH \* The Impact of Anxiety on Verbal Memory in Older Adults.
29. MORDECAI, K The Effects of Stress and Oral Contraceptive Use on Emotional Memory Retrieval in Young Women.
30. MORGAN, EE Item and Associative Memory in Methamphetamine Dependence.
31. MRAKOTSKY, C Corticosteroids, Immune Factors and Memory in Pediatric Chronic Illness: First Results on the Long-Term Effects of Steroids.
32. PANOS, SE Retention Deficits in Schizophrenia? Now You See Them...Now You Don't.
33. PETRAC, D ~~Self-Reported Lifetime Stress and Performance on Neuropsychological Tasks in Older Adults.~~
34. POREH, AM Analysis of Mean Learning of Normal Omani Young Adults on the Auditory-Verbal Learning Test.
35. RAMANATHAN, P Effects of Masked Lexical Priming on Metamemory Judgments in Brain Injury Survivors.
36. RANE, S \* Are Verbal and Nonverbal Stimuli Registered in Separate Working Memory Systems? Analysis of Selective Interference and Serial Position Curves.
37. RISHER, EL Depression and The Accuracy of Subjective Memory Complaints.
38. RUMBLE, S The Relationship of Processing Speed to Performance on the CVLT-C in a Pediatric Neurological Sample.
39. STERN, J Face-name association across life: do women always perform better?
40. TANNER, JJ Verbal List-learning and Memory in Dementia Patients: Understanding the Influence of Gray and White Matter.
41. TRAHAN, DE Continuous Visual Memory Test: Performance in Patients with Clinical Depression.
42. TRAHAN, DE Continuous Visual Memory Test: Performance in Patients with Anxiety Disorders.
43. WRIGHT, SL Relationship Between Five-Trial Verbal and Visuospatial Learning Tests in Healthy Participants.
44. YAM, A The Spatial Divide: Memory for Faces is a Relative Strength in Adults with Williams Syndrome.
45. ZAHODNE, LB Comparing Memory for Word Lists and Stories in Parkinson's Disease: Disease Effect or Psychometric Artifact?
- Other**
46. GOLD, DA Memory for Perceptual and Functional Attributes of Novel Naturalistic Actions (NNAs) Under Full and Divided Attention Conditions.
47. IVERSON, GL Cognitive Impairment in Children, Adolescents, and Adults with Mood Disorders: Does a Subgroup Drive the Effect?
48. MATTSON, SN Children with Heavy Prenatal Alcohol Exposure Show "What" and "Where" Visuospatial Deficits.
49. SOPER, A Cognitive Functioning Among Recently Abstinent and Current Methamphetamine (MA) Users.
- Psychopathology/Neuropsychiatry (Other)**
50. AVERY, E Attention and Inhibitory Control during Late Life Depression.
51. BENGE, J A Pilot Study of Executive Functions in PTSD.
52. BHALLA, RK Neuropsychological Functioning in Late-life Generalized Anxiety Disorder.
53. CERCY, SP Gray Matter Heterotopia Associated with Mild Cognitive Dysfunction.
54. CERCY, SP Delusional Misidentification in a Patient with Parkinson Disease.
55. CHAN, RC Stress reduces reward responsiveness in individuals with elevated depressive symptoms.
56. DEHGHANI ARANI, F ~~Effectiveness of Neurofeedback Treatment on Psychological Health, Craving and Abnormal Brain Activities in opiate dependent patients.~~
57. DICKINSON, M \* Effects of Dopamine Agonist Therapy in Patients With Parkinson's Disease.

58. GORLYN, M Antidepressant Medication Effects on Cognitive Functioning and Subjective Mood Mediate Suicidality in MDD.
59. HARTE, CB Depressive Symptomatology and Neurocognitive Performance.
60. ISAACS, KM Precipitating Events and Significant Life Stressors of Pediatric Patients Diagnosed with a Psychogenic Movement Disorder.
61. KEILP, JC Executive Dysfunction in Suicidal Behavior: A Correlate of Violence not Attempt Risk.
62. KILLGORE, WD Amygdala Responses of Specific Animal Phobics Do Not Differ from Healthy Controls During Masked Fearful Face Perception.
63. KILLGORE, WD \* Small Animal Phobics Show Sustained Amygdala Activation in Response to Masked Happy Facial Expressions.
64. LONG, EA Facial Affect Labeling and Social Judgments in Adolescents with Bipolar Disorder in Mixed or Depressed Mood States.
65. LUNDY, S Conditional-Associative Learning in Female Undergraduates "At-Risk" for Anorexia Nervosa and Obsessive-Compulsive Disorder.
66. MACKIN, S Suicidal Ideation is Associated with Poorer Performance on Measures of Executive Functioning in Individuals with Late Life Depression.
67. MCLAUGHLIN, NC Five Year Follow-Up of Gamma Knife Ventral Capsulotomy for Treatment Resistant Obsessive Compulsive Disorder: Preliminary Results.
68. NOGGLE, CA Degree to which Ratings on the Geriatric Depression Scale Demonstrate a Linear Relationship with Neurocognitive Outcomes on RBANS Domains.
69. NOGGLE, CA Profile Renderings of the MMPI-2 in a Sample of Patients Diagnosed with Fibromyalgia.
70. ROSTAMI, R The Effectiveness of Neurofeedback Treatment on Psychopathological Symptoms, Craving and Abnormal Brain Activities in Opiate Dependent Patients.
71. SOPER, A Risk Assessment of Cognitive Morbidity Associated With the Use of Therapeutic MDMA.
72. VELLA, L Correlates of Work History and Work Attainment in Supported Employment for People with Severe Mental Illness.
73. WRIGHT, SL The Double Burden of Age and Depression on Verbal Learning and Memory.
- Psychopathology/Neuropsychiatry (Schizophrenia)**
74. AMLUNG, MT Saccadic Performance and Its Relation to Self-Report Ratings of Schizotypy in Undergraduates.
75. CHAN, RC \* Effect of conversation prosody on emotion and intention identification in schizophrenia.
76. FRANTI, LM Problem Solving and Spatial Working Memory Decrements in Bipolar Patients.
77. GIANNAKOU, M Relationship Between Impaired Theory of Mind and Social Functioning in Schizophrenia.
78. GIULIANO, AJ ~~Neurocognition in Early Onset Schizophrenia and Schizoaffective Disorders.~~
79. MATSUI, M \* Characteristics of memory strategy and prefrontal brain volume in schizophrenia spectrum disorders.
80. RITCH, JL Awareness of Cognitive Abilities and the Risk of Self-Report in Schizophrenia.
81. SETER, C Characterizing Planning Behaviors in Schizophrenia: An Analysis of Everyday Action.

**10:15 AM–12:00 PM**

**Invited Symposium: Multidisciplinary Perspectives on Prefrontal Function and Dysfunction in Development, Adulthood, and Aging**  
**Chair: Paul Eslinger**  
**Marquis Ballroom B**

1. ESLINGER, PJ Multidisciplinary Perspectives on Prefrontal Function and Dysfunction in Development, Adulthood, and Aging.
2. ANDERSON, V The prefrontal cortex in children: No longer the silent?
3. GRAFMAN, J The Representation of a Life-Span in the Adult Human Prefrontal Cortex.
4. ESLINGER, PJ Executive Aging: Continuing Social and Cognitive Adaptation with Changing Resources.

**10:45 AM–12:15 PM**

**Paper Session 4: Imaging**  
**Marquis Ballroom A**

1. WOODARD, JL Prediction of Cognitive Decline in Older Adults over 1.5 Years with Functional Magnetic Resonance Imaging.
2. BRICKMAN, AM White Matter Hyperintensities and Cognition: Testing the Reserve Hypothesis.
3. DELANO-WOOD, L APOE ε4 Genotype Status Predicts Reduced Fornix Integrity in Alzheimer's Disease.
4. FOLEY, J Changes in Cerebral Volumes among Healthy Older Adults With and Without the Apolipoprotein Epsilon 4 Genetic Risk for Alzheimer's Disease: A Longitudinal Study.
5. WIERENGA, C Changes in the Neural Substrates of Semantic Memory in Nondemented Older Apolipoprotein E ε4 Carriers.

**10:45 AM–12:15 PM**

1. GIOVANNETTI, T
2. KESSLER, RK
3. PARK, NW
4. BICKERTON, W
5. BETTCHER, BM
6. MARSON, D

**Symposium 4: A Neuropsychological Approach to Everyday Action: Understanding Impairment to Inform Intervention**

**Chair: Tania Giovannetti**  
**Marquis Ballroom C**

- A Neuropsychological Approach to Everyday Action: Understanding Impairment to Inform Intervention.
- Principal Component Analysis of Everyday Action Errors in Schizophrenia.
- Cognitive Processes Mediating the Encoding and Production of Novel and Routine Naturalistic Actions.
- The Investigation of the Interactions between Action and Object Knowledge with Everyday Action of Patients with Neurological Damage.
- Everyday Error Monitoring Deficits in Dementia: An Environmental Intervention.
- Clinical Interview Assessment of Financial Capacity in Patients with MCI and Alzheimer's Disease.

**10:45 AM–12:15 PM**

1. TULSKY, DS
2. ALTMANN, LJ
3. BRADY, KD
4. DENHAM, M
5. GEHL, C
6. GRILLI, MD
7. JACKSON, A
8. JENSEN, K
9. KINGSLEY, KT
10. LANGILL, MA
11. LEISER, K
12. LORENZEN, B
13. MANNING, K
14. MILLER, K
15. MINGA, J
16. PERNA, R
17. SANZ, JH
18. SHIBASAKI, M
19. SZE, L
20. TREBLE, A
21. TREMONT, G
22. WOODS, DT
23. ZAKZANIS, K
24. HOOFIEN, D
25. BADENES, D
26. BARISA, MT
27. CACCAPPOLO, E

**Poster Session 3: Adult TBI, Intervention, Medical/Neurological Disorders Imperial Ballroom****Assessment/Psychometrics/Methods (Adult)**

New Initiatives to Develop Patient Reported Outcome Measures for Research with Neurological Populations.

**Cognitive Intervention/Rehabilitation**

- Exercise Effects on Cognition and Language in Parkinson's Disease: A Case Study.
- Cognitive Changes Following Constraint-Induced Movement Therapy (CIMT) for Children with Hemiparesis.
- All My Grandchildren: A Case Study of the Remediation of a Category-Specific Naming Deficit Following Temporal Lobe Epilepsy Surgery.
- Neuropsychological and Diagnostic Factors Associated with Outcome after Comprehensive Day Rehabilitation for Acquired Brain Injuries.
- \* "Self-Imagining" Enhances Recognition Memory in Memory-Impaired Individuals.
- Age Effects on Recovery from Acquired Brain Injury.
- Case Study: A New Interdisciplinary Approach to Individual Rehabilitation of Youths with Acquired Brain Injury.
- Mild Cognitive Impairment and Cognitive Rehabilitation: efficacy of intervention in combination with anticholinergic treatment.
- Remediation Efficacy of the Memory Notebook for Patients with Memory Dysfunction in Multiple Sclerosis.
- The Parent-Child Relationship and Cognitive Outcome in Preschoolers with a Neurological Insult. Integrating Physical Fitness Training into Traditional Speech-Language Treatment.
- \* Virtual Reality Driving: Can new measures help inform driving capacity in TBI?
- A Computer Fitness System for Older Adults: Evaluating the Effects of [M]POWER® by Dakim.
- An Analysis of Discourse Production and Working Memory in One Individual with Right Hemisphere Brain Damage (RBD).
- Acquired Brain Injury: Rehabilitation Gains and Return to Work.
- Treatment of Delirium with Aripiprazole Following Posterior Fossa Tumor Resection: A Case Study.
- Cognitive Rehabilitation of Activation in a Patient with a Frontal Lobe Lesion.
- Dejian Mind-Body Intervention Improves Self Control Ability of an Adolescent with Asperger's Disorder.
- Effectiveness and Generalization of a Cognitive Rehabilitation Program for Executive Dysfunction.
- Effects of Yoga on Cognitive Functioning in Older Adults with Memory Complaints: Preliminary Findings.
- Preliminary Treatment Acceptability of a Family-Centred Intervention for Parents of Children with an Acquired Brain Injury (ABI) – Pilot Study.
- A Multimodal Approach to Early Interventions in Mild Cognitive Impairment: A Meta-Analysis of the Literature.
- Compensation Seeking, Socio-Economic Status And Severity Of Injury As Predictors Of Effort In Neuropsychological Evaluation: A WMT Study.

**Other**

- PARKINSON DISEASE AND DRIVING.
- Neurosarcoidosis: A Neuropsychological Case Study.
- Neuropsychological Profile of Subjects with Early Onset Parkinson's Disease, with and without Parkin Gene Mutation.

28. COHEN, H  
29. DUX, M  
30. FITZGERALD-DEJEAN, DM  
31. GRACE, J  
32. HILSABECK, RC  
33. HOTH, KF  
34. HOTH, KF  
35. JULIAN, LJ  
36. MILLER, KM  
37. SCHIEHSER, DM  
38. STANEK, KM  
39. SZABO, AJ  
40. WHARTON, W  
41. WIMBERLY OLIVIER, T  
42. ZAHODNE, LB
43. ANDERSON, J  
44. BELKONEN, SM  
45. BENGEL, J  
46. BERCAW, EL  
47. BOATWRIGHT, B  
48. CHIOU, KS  
49. CLARK, JA  
50. CLEMENT, VL  
51. CRALIDIS, A  
52. DIKMEN, S  
53. GORDON, SN  
54. GREENBERG, LA  
55. HEATON, SC  
56. HEITZMAN, T  
57. HULL, A  
58. HUTSON, LR  
59. HUTSON, LR  
60. JOHNSON, C  
61. JOHNSON, AL  
62. KELLISON, I  
63. KIT, K  
64. LABBE, D  
65. LANGE, RT  
66. LANGE, RT  
67. LARSON, MJ
- NEUROPSYCHOLOGICAL PERFORMANCE IN CUSHING'S SYNDROME: 3-YEAR FOLLOW-UP STUDY CORRECTION OF HYPERCORTISOLISM.  
Clinical Neuropsychological Test Performance in Chronic Pain: Do Psychiatric History and Suboptimal Effort Underlie Observed Cognitive Deficits?  
Investigation of the Effect of Modified Tai Chi Training as a Component of a Multidisciplinary, Intensive Treatment Program for Individuals with Chronic Brain Damage.  
Impact of a cholinesterase inhibitor on sequential and reversal learning in Parkinson's disease.  
Higher Levels of Serum Cytokines are Associated with Poorer Cognitive Functioning in Patients with Chronic Hepatitis C.  
Improvements in Neuropsychological Performance Following Cardiac Resynchronization Therapy for Heart Failure.  
Changes in Cardiopulmonary Function and Cognition Following Medical Intervention for Emphysema.  
Cognitive and Physical Functioning among Patients with Chronic Obstructive Pulmonary Disorder.  
Arousal-modulated Startle Reflex Hyporeactivity in Parkinson's Disease.  
Longitudinal Change in Health-Related Quality of Life and Cognition in Parkinson's Disease.  
Cardiovascular Fitness is Associated with Cognitive Impairment and Mood Disturbances in Persons Referred for Nuclear Stress Tests.  
Cardiovascular Fitness, but not Ejection Fraction, is Associated with Specific Cognitive Function in Persons Referred for Nuclear Stress Tests.  
Cognitive and Demographic Characteristics of Women Enrolled in the KEEPS (Kronos Early Estrogen Prevention Study) Cognitive and Affective Study (KEEPS C/A).  
What is the Real Measure of Successful Rehabilitation?  
A Reliable Change Analysis of Cognitive Declines One Year after Unilateral Deep Brain Stimulation Surgery in Parkinson's Disease.
- TBI (Adult)**
- The Recovery of Time Estimation following Moderate to Severe Traumatic Brain Injury.  
Cognitive Functioning and Participation in Adults with Traumatic Brain Injury (TBI).  
\* Post-Concussive Symptoms in OEF/OIF Veterans: Factor Structure and Impact of PTSD Symptomatology.  
\* Cognitive Recovery After Traumatic Brain Injury (TBI) from Inpatient Rehabilitation to 1-year and 2-year Follow-up: Relationship to Functional Outcomes.  
Predicting Subjective Quality of Life One Year After Traumatic Brain Injury.  
Examining the Effect of Task Practice on Functional Brain Activation in Traumatic Brain Injury.  
Neuropsychological Profile of Combat Veterans Exposed to Mild Head Trauma and Combat-Related Stressful Events.  
WTAR Performance Scores Susceptible to Cognitive Impairment Early After TBI.  
Verbal Fluency Patterns in Individuals with Traumatic Brain Injury.  
Natural History of Post-Traumatic Symptoms.  
Effects of PTSD and Other Psychiatric Disorders on Cognitive Functioning in Veterans with Mild TBI.  
~~Facial Affect Recognition Ability in Veterans who Screen Positive for Traumatic Brain Injury (TBI): Contribution of Emotional and Cognitive Factors.~~  
Concurrent Validity of the Computer Adaptive Measure of Functional Cognition for Traumatic Brain Injury (CAMFC-TBI).  
Evaluating the Validity of the BISQ in a Sample of College Students With and Without Reported Head Injury.  
~~Comparison of the Repeatable Battery for Assessment of Neuropsychological Status (RBANS) and Neuropsychological Assessment Battery Screening Module (S-NAB) in Veterans Screened Positive for History of TBI.~~  
Long-Term Assessment of Recovery after Moderate to Severe TBI: Comparison of Two Community Re-Entry Scales, as rated by Patients and Informants, and their Relation to Coping Mechanisms.  
~~Neuropsychological Sequelae of Pure Blast Exposure Among Recent Combat Returnees Screened Positive for Traumatic Brain Injury (TBI).~~  
Subjective Organization Patterns Discriminate TBI From Other Populations.  
Neuropsychological Functioning and PTSD in OIF/OEF Veterans Exposed to Blasts: Preliminary Findings.  
Comparison of Adult Traumatic Brain Injury (TBI) Patient and Caregiver Ratings of Executive Functioning on the Behavior Rating Inventory of Executive Function (BRIEF-A).  
The Influence of Negative Stereotypes and Beliefs on Neuropsychological Test Performance in a Traumatic Brain Injury Population.  
Qualitative aspects of return to driving following traumatic brain injury.  
Differential Effects of Alcohol Intoxication on S100B Levels Following Traumatic Brain Injury.  
\* Diffusion Tensor Imaging as a Predictor of Postconcussion Symptoms Following Mild Traumatic Brain Injury.  
Conflict Adaptation and Cognitive Control Adjustment Following Severe Traumatic Brain Injury.



68. LEE-WILK, T Comparison Of The ARES For Palm OS Handheld PDA And ANAM Computerized Test Platforms In Mild Traumatic Brain Injury.
69. LENGENFELDER, J \* Using fMRI to Examine Verbal Learning in Individuals with Traumatic Brain Injury.
70. LIPPA, SM THE LARRABEE (2008) CRM TEST MALINGERING FORMULA: DOES IT PRODUCE FALSE POSITIVES IN CONSECUTIVELY ADMITTED SAMPLES OF SEVERE/MODERATE AND COMPLICATED MILD TBI PATIENTS WITH/WITHOUT A LAWSUIT AT 6 MONTHS POST INJURY?
71. LIVENGOOD, M Memory Self-Awareness Following TBI: Evaluating "Offline Assessment" And "Online Assessment" Methodologies.
72. MARQUEZ DE LA PLATA, CD Structural and Functional Interhemispheric Connectivity after Traumatic Brain Injury.
73. MCDONALD, S Deficits in Social Problem Solving following Traumatic Brain Injury: Are they related to Theory of Mind, Emotion Identification and Executive Functioning.
74. MCHUGH, T Predictive Value of the Neurobehavioral Functioning Inventory (NFI) in Mild Traumatic Brain Injury: A Front-line Measure to Identify Those in Need of Intervention.
75. ROSKOS, P The Effect of Depression on Cognitive Screening and Functional Outcome in Traumatic Brain Injury (TBI) Patients.
76. ROSKOS, P Use of the Geriatric Depression Scale With Younger and Older Adult Traumatic Brain Injury (TBI) Patients.
77. RUSSELL, K Lower Level Language Deficits After Traumatic Brain Injury.
78. SHANDERA, AL Psychological Profiles of Combat Veterans Exposed to Mild Head Trauma and Combat-Related Stressful Events: Preliminary Findings.
79. SHORE, P Preliminary Findings on Neuropsychological Correlates of Self-Reported Cognitive Impairment Among OIF/OEF Combat Vets with Exposure to Blasts.
80. THORNTON, GM Relation Between Postconcussive Symptoms, Brain Injury Severity Characteristics, and Posttraumatic Stress in OEF/OIF Veterans.
81. TINKER, J The Relationship between Reported Visual Disturbance and Post-Concussion Cognitive Function in Collegiate Athletes.
82. VAN ORDEN, OR Performance on a Computerized Measure of Attention as a Predictor of Persistent Cognitive Symptoms Following Mild Traumatic Brain Injury.
83. WATSON, W The Relationship between Early Glasgow Coma Scale (GCS) Scores and Later General Functional and Cognitive Outcome in Adult Severe Traumatic Brain Injury (TBI).
84. WHITFIELD, K \* Self-reported Concussion Exposure Predicts Neurocognition in Elite Athletes.
85. YI, AS WAIS-III Vocabulary: Is it a valid test of premorbid intellectual functioning for older adults with traumatic brain injury (TBI)?
86. ZGALJARDIC, DJ Relationship Between the Neuropsychological Assessment Battery Screening Module (NAB-SM) and Functional Independence in Post-Acute Brain Injury Rehabilitation.
87. ZGALJARDIC, DJ Internal consistency and construct validity of the Neuropsychological Assessment Battery Screening Module (NAB-SM) in a sample of individuals with acquired brain injury (ABI).
- Dementia (Subcortical, Specific Disorders, MCI, etc.)**
88. GROSSMAN, H Differentiation of MCI Subtype Using a Conceptual Composite Score on the Clock Drawing Test.

12:00–1:30 PM

**Thursday Lunchtime Continuing Education Seminars**  
**Refer to CE schedule for location**

1:15–2:45 PM

**Poster Session 4: Cancer, Epilepsy, Stroke/Aneurysm, MS/Demyelinating**  
**Imperial Ballroom**

**Cancer**

1. ASHFORD, JM Attention and Working Memory Abilities in Children Treated for Acute Lymphoblastic Leukemia.
2. CARON, JE \* Oxidative stress and executive functioning in pediatric ALL patients undergoing chemotherapy.
3. CONKLIN, HM \* Side Effects of Methylphenidate in Survivors of Childhood Cancer: A Randomized, Double-Blind, Placebo-Controlled Trial.
4. CONKLIN, HM Long-Term Effectiveness of Methylphenidate in Enhancing Attention Regulation, Academic Abilities and Social Skills in Survivors of Childhood Cancer.
5. FISCHER, BL Chemotherapy Contributes to Decline in Memory and Processing Speed.
6. JAIN, N \* Sex-specific Executive Attention Problems in Long-term Pediatric Acute Lymphoblastic Leukemia (ALL) Survivors.
7. JAIN, N Assessment of Neurocognitive Function in Very Long-Term Survivors of Pediatric Cancer.
8. KOHL, AD Neurological Predictors of Academic Achievement in Adult Survivors of Childhood Brain Tumor.
9. LEJBAK, LK The Effect of Anti-Estrogen Medication Prescribed in the Treatment of Breast Cancer on Estrogen-Sensitive Neuropsychological Domains.
10. MELTON, A Academic Fluency Deficits in Children Treated for Brain Tumors.
11. MUMAW, MA Prefrontal White Matter Integrity and N-back Performance in Adult Survivors of Childhood Brain Tumors.

12. MYERS, A  
 13. MYERS, A  
 14. NAIDOO, R  
 15. O'BRIEN, KA  
 16. PEREZ, R  
 17. STENZEL, SS  
 18. VAUX, LM  
 19. VEARNCOMBE, KJ  
 20. WALSH, KS  
 21. YAMADA, T  
 22. BAUM, KT  
 23. BEGYN, EL  
 24. BRAATEN, A  
 25. BUSCH, RM  
 26. CONSTANTINIDOU, F  
 27. FELIX, L  
 28. GRIFFITH, NM  
 29. HANTKE, N  
 30. HUNTER, SJ  
 31. JOHNSON-MARKVE, BL  
 32. JONES, J  
 33. MILLER, LE  
 34. PAPAZOGLU, A  
 35. PARFENE, C  
 36. PULSIPHER, DT  
 37. RAMIREZ, M  
 38. RAMIREZ, M  
 39. RECKESS, GZ  
 40. SACHS, BC  
 41. SAN MIGUEL, L  
 42. SEPETA, L  
 43. SHERMAN, EM  
 44. SOPER, A  
 45. TUCHSCHERER, VN  
 46. ZABEL, TA  
 47. ANDERSON, CR  
 48. BARWICK, F  
 49. BASSO, MR  
 50. BASSO, MR  
 51. BAUGHMAN, BC  
 52. BRUCE, J  
 53. CAPILI, E  
 54. JULIAN, LJ
- Cognitive Disabilities Among Leukemia Survivors.  
 Academic Achievements of Children with Brain Tumors.  
~~Assessing Neurocognitive Functioning of Pediatric Neuro-Oncology Patients: The Challenges-~~  
 Surgical Morbidity in Patients with Low Grade Glioma.  
 Behavioral Sequelae of Childhood Surgical Resection of Cerebellar Pilocytic Astrocytomas.  
 \* Oxidative Stress and Neurobehavioral Problems in Pediatric ALL Patients Undergoing Chemotherapy.  
 Patterns of Neuropsychological Functioning Among Cancer Survivors.  
 Specific Cognitive Decline: Domains and Associated Contributing Factors for Cognitive Dysfunction after Chemotherapy.  
 Neuroradiographic Features of Patients with the Cerebellar Mutism Syndrome: A Longitudinal MRI Study.  
 Cognitive and Psychosocial Well-Being in Breast Cancer Survivors.
- Epilepsy/Seizures**
- Associative Memory Strategies in Children with New-Onset Seizures.  
 Differences in Parent-Reported Executive Functioning in Pediatric Seizure Disorders.  
 The Effects of Handedness and Side of Seizure Focus on Neuropsychological Test Performance in Patients with Temporal Lobe Epilepsy.  
~~Patients with Frontal and Temporal Lobe Epilepsies Report Similar Emotional and Personality Traits.~~  
 The Effects of Chronic Epilepsy on Working Memory Performance and Executive Abilities.  
 The Relative Contribution of Executive Functioning to the Relationship between Cognitive and Academic Functioning in Children with Epilepsy.  
 Exploring the Relationships Between Explanatory Style and Depressive Symptoms Among Patients with Intractable Seizure Disorders: Optimism and Pessimism as Predictors of Seizure Group.  
 The Personality Assessment Inventory as a Tool for Diagnosing Psychogenic Non-epileptic Seizures.  
 Neuropsychological moderators of social skills in children with complex partial and primary generalized epilepsy.  
 Prognostic Utility of a Prediction Model for Memory Decline Following Epilepsy Surgery.  
 Daytime Sleepiness in Children and Adolescents with Epilepsy.  
 A Comparison Of Configurational And Detail Elements Of The Taylor Complex Figure Test in Determining Seizure Laterality.  
 Poor Seizure Control is Associated with Reduced Adaptive Functioning in Children with Epilepsy.  
 Does Caring for a Child with Epilepsy Lead to Workplace Discrimination?  
 Executive Functioning in Pediatric Epilepsy: A Prospective Longitudinal Study.  
 Boston Naming Test Performance in Mesial Temporal Lobe and Frontal Lobe Epilepsy: A Quantitative and Qualitative Analysis.  
 Perceived Emotional Distress and Confrontation Naming Performance in Intractable Epilepsy.  
 Spatial Navigation after Right Anterior Temporal Lobectomy: Mixed Findings Using a Virtual Water Maze.  
 \* Category Specific Naming Deficits for Famous Faces in Post-Surgical Patients with Language-Dominant Temporal Lobe Epilepsy.  
 Classificatory Utility of Large Intra-individual WISC-R Variability in Focal Versus Generalized Seizures: Data Across Countries and Cultures.  
 Intracarotid Amobarbital Procedure (IAP): Is the Right Hemisphere Wada Test Really Necessary?  
 In the Eye of the Beholder: Discrepancies in Parent and Teacher Ratings of ADHD Symptoms in Children with Epilepsy.  
 Transient Epileptic Amnesia: A Case Series of a Treatable Memory Disorder.  
 Role of Thalamic Volume in TLE Memory Performance.  
 Neuropsychological distinctions in patients with Sturge-Weber Syndrome and posterior versus diffuse MRI findings: Four case reports.
- Multiple Sclerosis/ALS/Demyelinating Disorders**
- The Role of Executive Functioning in Verbal Memory in Patients with Multiple Sclerosis.  
~~Do Patient and Significant Other Ratings of Vegetative Depression Symptoms Reflect Limitations in MS Patients' Physical Activity and Mobility?~~  
 Neuropsychological Impairment and Major Depression Compromise Medical Research Decision-Making Capacity in Multiple Sclerosis.  
 \* Emotion Perception Deficits Correlate with Compromised Social Functioning in Multiple Sclerosis.  
 Staying on the Job: Correlates of work performance among employed M.S. patient.  
 The relationship between self-report and objective measures of medication adherence in relapsing-remitting multiple sclerosis.  
 \* Cognitive Fatigue in Multiple Sclerosis Using fMRI: a Pilot Study Examining the Relationship Between Objective and Subjective Measures.  
~~Associations among Neurological Disability, Cognitive Dysfunction, and Longitudinal Outcomes in Multiple Sclerosis.~~

55. KURTZ, S The Relationship between Global Neurological Impairment and Neuropsychological Functioning using Computerized Testing in Multiple Sclerosis.
56. MORROW, SA \* Efficacy and Safety of l-Amphetamine Sulfate on Cognitive Function in MS Patients.
57. RABINOWITZ, AR Mediators of MS Symptoms' Effects on Contentment.
58. STRUTT, AM Respiratory Function is not Related to Cognitive Impairment in Patients with Amyotrophic Lateral Sclerosis (ALS).
59. SUMOWSKI, JF Cognitive Reserve Protects Against Learning and Memory Dysfunction in Multiple Sclerosis.
60. SUMOWSKI, JF Functional Neuroimaging of Cognitive Reserve in Multiple Sclerosis: Implications for the Default Mode Network.
61. SWEET, LH Cognitive Processing Speed and Verbal Working Memory in Multiple Sclerosis.
62. VARGAS, GA Social Support and Uplifts Interact to Predict Depression in Patients with Multiple Sclerosis.
- Other**
63. BENJAMIN, C The space and time of memory: Spatial and temporal binding in healthy adults and left Temporal Lobe Epilepsy.
64. DI-PINTO, M ~~An Investigation of Verbal Learning and Visual Auditory Learning after Conformal Radiation Therapy in Children with Localized CNS Tumors.~~
- Stroke/Aneurysm**
65. BANOS, J Predictors of Orientation Log and Cognitive Log Performance in Stroke Patients.
66. BLOOM, JS Caregiver Perceptions of Traumatic Stress Symptoms in Children and Families Following Pediatric Stroke: A Pilot Study.
67. CERNICH, AN Feasibility of Computerized Neuropsychological Assessment for Cognitive Screening in the Chronic Stroke Population.
68. EVANS, CG ~~Comparison of the FIM Cognitive subscale and RBANS in an Acute Stroke Rehabilitation Sample.~~
69. NOGGLE, CA Links Between RBANS Indices and ILS Performance Following Cerebrovascular Events.
70. NOGGLE, CA Converging and Diverging Correlational Patterns of the RBANS Indices and ILS Based on Hemispheric Origin of Cerebrovascular Accidents.
71. SCHWARZ, L Examination of Cognitive Functioning in North American Adults with Moyamoya Disease Utilizing the RBANS.
72. THOMPSON, R Parental Perceptions of Cognitive Changes and Academic Outcomes Following Pediatric Stroke.
73. TRAHAN, DE Continuous Visual Memory Test: Performance in Patients with Anterior Communicating Artery Aneurysms.
74. VICKERY, C Admission Functional Status and Rate of Functional Change Do Not Predict Depressive Symptoms at Discharge from the Acute Stroke Rehabilitation Setting.
75. WILLIAMSON, J Hemispheric white matter integrity predicts shift to peripheral regulation of the autonomic nervous system in a stroke population.

**1:30–3:00 PM**

1. KIM, MS Cognitive and Psychiatric Predictors of Medication Adherence: A Cluster Analytic Approach.
2. BECKER, BW Longitudinal Study of Neurocognitive Function and Medication Adherence in HIV-Positive Adults: Association with Apathy and Stimulant Use.
3. FOLEY, J Effects of Cerebrovascular Risk versus Age upon Cognitive Functioning in HIV-1-Infected Patients.
4. BOUSMAN, CA Catechol-O-Methyltransferase, Executive Dysfunction, and Sexual Risk Behavior in the Context of HIV-Infection and Methamphetamine Dependence.
5. TATE, DF Para-sagittal Corpus Callosum Fractional Anisotropy is Associated With Measures of Attention and Motor Function Among HIV Infected Patients.

**1:45–2:45 PM**

1. GRIGORENKO, E **Invited Plenary: Reading the Genome for Genes for Reading**  
**Speaker: Elena Grigorenko**  
**Marquis Ballroom B**  
Reading the Genome for Genes for Reading.

**1:30–3:00 PM**

1. GLEASON, CE **Paper Session 6: Alzheimer's, Aging, and Apolipoprotein E**  
**Marquis Ballroom C**  
Cognitive performance of hormone therapy users and nonusers at-risk for Alzheimer's disease.
2. WOODARD, JL Apolipoprotein E ε4 Adversely Impacts Cognitive and Functional Status in Caucasian Centenarians but not in African American Centenarians.
3. WISDOM, NM The Effects of Apolipoprotein E on Nondemented Cognitive Functioning: A Meta-Analysis.
4. LINEWEAVER, TT Knowledge of Genetic Risk for Alzheimer's Disease Impacts Both Subjective and Objective Memory.
5. BLOSS, CS Compromised Cognition in Children with Risk Factors for Alzheimer's Disease.

**3:00–4:30 PM**

1. MEDINA, LD
2. MARQUINE, M
3. MARSON, D
4. TEAGUE, EB
5. POTTER, G

**Paper Session 7: Alzheimer's Disease**  
**Marquis Ballroom B**

Metamemory in Familial Alzheimer's Disease Mutation Carriers.  
 Self- and Other-Person Knowledge in Alzheimer's Disease and Mild Cognitive Impairment.  
 Neurocognitive Models of Financial Capacity Across the Dementia Spectrum: Normal Aging, MCI, and AD.  
 Early Neuropsychological Markers of Alzheimer's Disease among Asymptomatic Siblings of Alzheimer's Patients: A Longitudinal Study.  
 Neuropsychological Prediction of Conversion to Alzheimer's Disease in Late-Life Depression.

**3:15–4:45 PM**

1. SEAL, BC
2. BELZNER, KA
3. SEAL, BC
4. STOGNER, BL

**Symposium 5: Developmental Changes in the Sign and Spoken Communication of Young Cochlear Implant Recipients**  
**Chair: Brenda Seal**  
**Marquis Ballroom A**

Developmental Changes in the Sign and Spoken Communication of Young Cochlear Implant Recipients.  
 Longitudinal Outcomes in a Diverse Sample of Deaf Children with Cochlear Implants.  
 Speech and Sign Acquisition Trajectories and Correlations Across Three Age Groups.  
 Communication Development Before, During, and After Sign Language Intervention with an Auditory Neuropathy/Dys-synchrony (AN/AD) Case and his Typically-Developing Monozygotic Twin.

**3:15–4:45 PM**

1. ESPY, KA
2. ESPY, KA
3. WASHBURN, D
4. SCHOEMAKER, K
5. PRITCHARD, V
6. GERRARD-MORRIS, A

**Symposium 6: Translational Science: Using the Shape School to Probe Ontogeny, Development, and its Deviations**  
**Chair: Kimberly Espy**  
**Marquis Ballroom C**

Translational Science: Using the Shape School to probe ontogeny, development, and its deviations.  
 Developmental Trajectories of Executive Processing on the Shape School.  
 Simians Attend the Shape School.  
 Shape School task in preschool children with behavior problems.  
 Cerebral abnormalities on neonatal MR and later inhibitory and switching abilities in preschool children born very preterm.  
 Effects of Early Childhood Traumatic Brain Injury (TBI) on Development of Executive Functions as Measured by the Shape School.

**3:15–4:45 PM**

1. AHMED, FS
2. ARAUJO, G
3. ARENTOFT, A
4. BANERJEE, P
5. BARBOZA, FF
6. BARBOZA, FF
7. BARISA, MT
8. BUELOW, M
9. CHAN, RC
10. CHAN, RC
11. CHAN, RC
12. CHRIST, SE
13. COULEHAN, K
14. DAWSON, E
15. DIPINO, RK
16. EASTVOLD, A
17. FOSTER, S

**Poster Session 5: Neurocognitive Functions**  
**Imperial Ballroom**

**Executive Functions/Frontal Lobes**

The Relationship Between Executive Function and Theory of Mind.  
 Response Monitoring in Children with Phenylketonuria.  
 The Influence of Exercise and Eating Habits on Cognitive Performance in Obese and Non-Obese Adolescents.  
 Strategic Processing in Children with Phenylketonuria.  
 Language Function Regulation: a propose of a instrument to differential diagnostic of Fragile X Syndrome.  
 Development of the Regulatory Function of the Language and Frontal Maturation in different ages in a public Creche in the City of Salvador – Bahia – Brazil.  
 A Case Presentation of Capgras Syndrome and Reduplicative Paramnesia in a Patient With Probable Frontal Lobe Dementia.  
 Personality and State Mood Affect IGT Performance.  
 A cross-sectional and longitudinal study of multitasking performance in school-aged children.  
 Prevalence of neurological soft signs and their neuropsychological correlates in healthy Chinese children.  
~~Developmental patterns in the detection of faux pas in healthy school-aged Chinese children: Relationship to executive functions.~~  
 Early-Treated Phenylketonuria and Prefrontal Dysfunction: Evidence from Functional Magnetic Resonance Imaging.  
 Early School-age Executive Functioning of Extremely Low Birth Weight Infants with Bronchopulmonary Dysplasia.  
 Impulsivity and Social Functioning in Healthy Young Adults.  
 Examination of the Relationship between Executive Cognitive Function and Psychopathology in Individuals with Traumatic Brain Injury.  
 Reduced processing speed in adult pedophilic men.  
 Wisconsin Card Sort Across the Lifespan (5 – 89): Cognitive Abilities Contributing to Performance.

18. FOSTER, S
  19. FOSTER, PS
  20. GARCIA, MC
  21. HATFIELD-ELDRED, M
  22. ILARDI, D
  23. JACKSON, J
  24. JACOBSON, LA
  25. JANKE, KM
  26. KESSLER, RK
  27. KILLGORE, WD
  28. KILLGORE, WD
  29. KRUEGER, CE
  30. LOKKEN, KL
  31. LUBOYESKI, E
  32. MCFARLAND, CP
  33. MOFFITT, A
  34. MOLNAR, AE
  35. MORTON, CH
  36. MOZEIKO, J
  37. NGUYEN, PT
  38. PYYKKONEN, B
  39. RANSOM, MT
  40. ROSS, TP
  41. SKEEL, R
  42. SORENSEN, LG
  43. SPRINGER, US
  44. STAVRINOS, D
  45. SUHR, J
  46. SUNDERMANN, EE
  47. TORRES, R
  48. WARNER, TD
  49. WELSH, M
  50. WELSH, M
  51. WINGO, JM
  52. WOOLSTON, DJ
  53. WURST, LM
  54. YOASH-GANTZ, RE
  55. ZABEL, TA
  56. ABEARE, C
  57. CANCELLIERE, A
  58. CRANFILL, TB
  59. CRUCIAN, GP
  60. FITZGERALD, KM
  61. GEFEN, TD
  62. LAURES-GORE, J
  63. LEDOUX, K
  64. MOORE, AB
- Planning (TOH) Across the Lifespan (5-89): Cognitive Abilities Contributing to Performance.  
 Depression and Lateral Onset Parkinson's Disease: Differential Effects on Working Memory.  
 The Effects of Bilingualism on Working Memory in an Attention-Deficit/Hyperactivity Disorder Population.  
 The Effect of Working Memory Capacity on Impulsive Decision-Making.  
 Executive Functioning Deficits Predict Academic Problems in Children with Sleep Disordered Breathing.  
 Visuospatial performance and executive functioning in patients with spina bifida.  
 \* Executive Function Skills and Children's Academic and Social Adjustment to Sixth Grade.  
 "Hot" and "Cool" Executive Functioning in Children and Adolescents with Williams Syndrome.  
 What Accounts for Switching Difficulties in Schizophrenia?  
 Odor Identification Ability Predicts Executive Function Deficits Following Sleep Deprivation.  
 Differential Effects of Stimulant Medications on Verbal and Nonverbal Fluency During Sleep Deprivation.  
 Executive Functioning in Children with Posttraumatic Stress Disorder.  
 Relationship between decision making and post-surgical weight loss following bariatric surgery.  
 Self-Reported Executive Functions, College Adjustment, and the Mediation Effect of Depression.  
 Frontal Lobe Involvement in a Verbal Switching Task.  
 The Relationship between Working Memory and Inhibitory Control in Individuals with Phenylketonuria.  
 Executive Functioning Deficits in Children with ADHD-C, ADHD-PI, and Dyslexia on the Parent and Teacher BRIEF.  
 Relationship between Parental Report of Executive Functioning Using the BRIEF and Child Performance on the TEA-Ch.  
 Discourse Performance Associated with Left Dorsolateral Prefrontal Cortex Lesions.  
 The impact of ADHD and reading deficits on working memory.  
 An Analysis of the Unique Contribution of Executive Functioning, Language and Verbal Memory to Verbal Fluency Tasks Using Hierarchical Regression.  
 Does Executive Functioning Differentiate Patients with MCI and Depression from Those with Depression Alone?  
 The Reliability and Validity of Quantitative and Qualitative Scores for the Ruff Figural Fluency Test.  
 Instructional Set Impacts Performance on the Iowa Gambling Task.  
 \* Executive Functioning Following Liver Transplantation in Early Childhood – Preliminary Results of the Functional Outcomes Group (FOG).  
 Computerized Self-Ordered Working Memory Performance in Nondemented Parkinson Disease.  
 Assessing Executive Functioning In Children With Attention-Deficit/Hyperactivity Disorder, Combined Type.  
 Who Fails the Iowa Gambling Task? Personality, Neuropsychological, and Neuroimaging Findings.  
 The Effects of Stress and Oral Contraceptives on Cognitive Flexibility.  
 The Relationship Between Performance on Attention/Executive Functioning Tests and Parent Report of Externalizing Behavior Problems in Three-Year-Old Twins.  
 No Effect of Prenatal Cocaine Exposure on the Wisconsin Card Sorting Test Performance During Early Adolescence.  
 Predictors of High School Attrition among High-Risk Teenagers: Executive Function and Risk Assessment.  
 A Critical Thinking Skills Intervention for High-Risk Teenagers: Associations with Executive Functions.  
 Effects of Bilingualism on Executive Functions.  
 Construct Validity of the Texas Card Sorting Test (TCST) in Epilepsy.  
 Set-Shifting is Associated with Left Middle Frontal and Right Superior Frontal Gray Matter Atrophy in Neurodegenerative Disease.  
 Relationship of Neurobehavioral Symptoms, PTSD and TBI in Returning Combat Veterans.  
 Discrepancies in parent- and self-report of executive dysfunction in youth with myelomeningocele and shunted hydrocephalus.
- Language and Speech Functions/Aphasia**
- Neuropsychological Correlates of Clustering and Switching on the COWAT.  
 Differential Performance In Naming Pictures Versus Definitions In Moya Moya Disease with Bilateral Cerebral Infarcts (left greater than right).  
 Psychosocial Measures and Aphasiology.  
 \* Associational Strength Influences Response Latency in Single-Word Association.  
 Perseverative Errors as a Function of Age, Hearing Ability, and Contextual Constraint.  
 Enhancing Top-Down Processing to Remediate Hemianopic Alexia.  
 Forward and Backward Digit Span in Aphasia.  
 Development, Reliability, and Construct Validity of a New Approach to Analyzing Qualitative Aspects of Speeded Lexical Retrieval.  
 Manipulations of Visual Parameters and Lexical-Semantic Information on Object Naming.

65. MURRAY, L  
 66. NAKANISHI, C  
 67. OGBURN, AC  
 68. SANCHEZ, CE  
 69. SCHAEFER, LA  
 70. SEELY, PW  
 71. SMITH, MM  
 72. STEFANATOS, GA  
 73. ZLATAR, ZZ

\* A Comparison of Two Writing Treatments for Severe Anomia.  
 The role of the left temporal lobe in learning Kanji characters.  
 Lexical and Environmental Processing and Recovery Patterns in Aphasia: A Pilot Study.  
 Language Dysfunction as an Indicator of Underlying Neurological Complications in Pediatric Sickle Cell Anemia.  
 A Case Of Acute Crossed Conduction Aphasia Superimposed On Vascular Dementia.  
 The Wisdom of Age, the Spice of Youth. What is SAGE?  
 Dysarthria and Speeded Cognitive Tasks in MS: Replication and Examination of the Validity of Examiner Ratings.  
 Dextroamphetamine improves attention to speech in aphasia.  
 \* Lesion Severity Predicting Right-hemisphere Homologous Activity and Treatment Improvement in Non-fluent Aphasia.

### Other

74. LE, K  
 The Effect of Penetrating Head Injury on Symbolic and Spontaneous Communication.

### Visuospatial Functions/Neglect/Agnosia

75. CHEN, P  
 76. JACKSON, A  
 77. NAKAGAWA, Y  
 78. WALSH, KS  
 79. ZUFFANTE, P

Visuospatial memory training for right hemisphere stroke.  
 Ecological Validity: Rey Complex Figure Test and Independent Living Skills.  
 Selective impairment of shape recognition defined by color and binocular disparity caused by bilateral ventro-medial occipital lesions.  
 Contribution of Attention and Executive Function in the Presentation of Visuospatial Deficit in Children with NF-1.  
 Developmental Number-Symbol Visual-Tactile Agnosia.

### 4:45–5:45 PM

**Birch Lecture: The Goldilocks Dilemma In Neurodevelopmental Disorders: A Functional Brain That Is Not Too Big, Not Too Small, But Just Right**  
**Speaker: Maureen Dennis**  
**Marquis Ballroom B**

1. DENNIS, M  
 Birch Lecture The Goldilocks Dilemma In Neurodevelopmental Disorders: A Functional Brain That Is Not Too Big, Not Too Small, But Just Right.

## FRIDAY, FEBRUARY 13, 2009

### 7:20–8:50 AM

**Friday Morning Continuing Education Seminars**  
**Refer to CE schedule for location**

### 9:00–10:30 AM

**Symposium 7: The Nature of Neurobehavioral Impairments in Children Born Very Preterm.**  
**Chair: Peter Anderson, Discussant: H. Gerry Taylor**  
**Marquis Ballroom A**

1. ANDERSON, PJ  
 2. ANDERSON, PJ  
 3. BARON, I  
 4. ESPY, K  
 5. WOODWARD, LJ  
 6. DEWEY, D  
 7. NOSARTI, C

The Nature of Neurobehavioral Impairments in Children Born Very Preterm.  
 Brain Metrics at Term Equivalent Age Predicts Early Cognitive and Motor Development in Very Preterm Children.  
 Neurobehavioral and Cognitive Outcomes of Extremely Preterm, Late Preterm, and Term Birth at Three-Years-Old: A Single Center Study.  
 Using Cognitive Science Tools to Elucidate Mechanisms of Inattention in Preschoolers Born Preterm.  
 Neonatal White Matter Abnormalities Predict Neurocognitive Outcome in Children Born Very Preterm.  
 Motor Impairment in Children with Birth Weight < 1000 g: Prevalence and Identification.  
 The Impact of Very Preterm Birth on the Functional Neuronal Development of Episodic Memory in Adulthood.

### 9:00–10:00 AM

**Invited Plenary: Aging of Cognition from 18 to 60**  
**Speaker: Timothy Salthouse**  
**Marquis Ballroom B**

1. SALTHOUSE, T  
 Aging of Cognition from 18 to 60.

## 9:00–10:30 AM

1. BALDWIN, E
2. BALDWIN, E
3. BUTTERFIELD, LC
4. DRAGO, V
5. DRAGO, V
6. DRAGO, V
7. HORNADAY, AJ
8. JOHNSON, N
9. MAHANEY, T
10. MYERS, A
11. NEMETH, DG
12. OELKE, L
13. PISHORI, AZ
14. STAMENOVA, V
15. ALBERTS, JW
16. BOWERS, D
17. CLARK, CA
18. COATES, MA
19. FEINSTEIN, JS
20. FERRETT, HL
21. GOODRICH-HUNSAKER, N
22. JEGEDE, A
23. KAUFMAN, DA
24. KAZANDJIAN, S
25. KILLGORE, WD
26. LANDRO, NI
27. LEININGER, SL
28. LEO, PD
29. PARSONS, TD
30. PARSONS, TD
31. PARSONS, TD
32. SCHWARTZ, MF
33. THOMA, RJ
34. WALDRON, E
35. CANTOR, D
36. CHEUNG, M
37. CLANTON, NR
38. DAVE, JB
39. HARTZELL, A
40. HOLLAND, AK
41. KEY, AP
42. KIM, M
43. KING, AM
44. MOLFESE, PJ

## Poster Session 6: Imaging, Cognitive Neuroscience, Behavioral Neurology Imperial Ballroom

### Behavioral Neurology

- Wernicke's Encephalopathy in a Non-Alcoholic Patient: Neuropsychological Features and Imaging Findings.
- Clinical Implications of Cerebellar Damage: A Case Study.
- Apathy, Depression, and Cognitive Functioning in Parkinson's Disease.
- Creativity in Parkinson disease as a function of right versus left hemibody onset.
- Turning off artistic ability: The Influence of Left DBS in Art Production.
- Distractibility and Alzheimer Disease: the "neglected" phenomenon.
- \* Perseveration: Patterns of Response and Neuropsychological Context.
- Impulse control problems in Parkinson disease do not impact performance on the Iowa gambling task.
- Case Analysis of Langerhans Cell Histiocytosis: 2 Differing Cases.
- Is Sleep Important Among Caregivers??
- Neurocognitive Sequelae of a Family Chronically Exposed to Carbon Monoxide Gas.
- The Unique Effects of Anxiety and Depression on Cognitive Functioning in Parkinson's Disease.
- \* Crystallized Knowledge of Social Norms Is Negatively Impacted by Neurodegenerative Disease.
- Recognition and production of gesture errors in limb apraxia after stroke.

### Cognitive Neuroscience

- When Our Memories Fail Us: Exploring The Accuracy and Inaccuracy of Memory.
- Dopamine and Masked Faces in Parkinson Disease: Timing is Key.
- \* Verbal and Visuo-Spatial Working Memory in Children Born Very Preterm at Age 6 Years.
- Event Related Potential Evidence for Task-Set Switching in the Implicit Association Test.
- Bilateral Limbic System Destruction In Man.
- Neuropsychological Performance of South African Adolescent Treatment-naive Alcohol Users.
- Symptom Validity Testing: Word Memory Test Performance, Hippocampal Damage and Declarative Memory Impairments.
- Blood Pressure and Cerebral Blood Flow Response to the Stroop Color-Word Task in Persons with Spinal Cord Injury.
- Verbal Working Memory Contributions to Creativity.
- Bidirectional Reading on Cancellation Task Performance.
- When Being Smart is a Liability: More Intelligent Individuals May Be Less Resistant to Sleep Deprivation.
- ~~The Effects of 5-HTTLPR Polymorphisms and Gender on Cognitive Control and on Processing of Emotional Facial Expressions.~~
- The Effects of Reward Magnitude Discrepancies and Uncertainty Periods on Michigan Gambling Task (MGT) Performance.
- The hippocampus and inference: an fMRI analysis.
- High and Low Immersion in Virtual Reality: A Psychophysiological Assessment.
- Psychophysiological Affects of High and Low Levels of Immersion in an Iraqi Virtual Environment on West Point Cadets and Civilian Controls.
- Psychophysiological Correlates of Immersive Tendencies in Virtual Environments.
- Factor Analysis of Aphasia Battery Validates the Semantic-Phonological Distinction in Input and Output Word Processing.
- Impaired Ipsilateral Sensory Gating and Memory Performance in Unilateral Temporal Lobe Resection.
- Past Tense Verb Generation Depends Upon Word Age of Acquisition: Evidence from fMRI.

### Electrophysiology/EEG/ERP

- QEEG and VARETA/LORETA Correlates to Neuropsychological Performance.
- A Quantitative Electroencephalography Study of Reading English Words and Chinese Characters.
- Psychophysiological Correlates of Aggressive Behavior in Children: An Examination of Differences Between Recovery Responses.
- Differential FDDNP PET Patterns in Persons with Amnesic Mild Cognitive Impairment and Normal Cognition.
- Beta and Gamma Contributions to P50 Subcomponent Abnormalities in Schizophrenia and their Relationship to Neuropsychological Indices of Attention.
- Changes in Temporal Beta Activation as a Function of Hostility and Stress.
- Affective Processing In Adults With Williams Syndrome: ERP Evidence of Social Bias.
- Electrophysiological correlates of local-global processing in a sub-clinical obsessive-compulsive sample.
- Event Related Potentials Express the Impact of Stress and Sleep Loss via an Auditory Attention Task.
- A Longitudinal Study Of Brain Response Changes To Speech In Monozygotic And Dizygotic Twins From 6 To 18 Months Of Age.

45. O'BRIEN, KM The Effects of Minor Sleep Restriction Elicited by an Oddball Task.  
 46. STARKEY, G Cortical Activation During a Shape Matching Task Shows Support for Theory of Neurodevelopmental Organization.
- Imaging (Functional)**
47. BANGEN, KJ Effect of APOE Genotype on Brain Activation during Memory Encoding: An Arterial Spin Labeling Study.  
 48. CASTILLO, EM Changes in cortical oscillatory activity and functional recovery after stroke: a follow-up MEG study.  
 49. CASTILLO, EM Normalization of mu Rhythms and improvement in motor function after stroke.  
 50. DAVIS, N An fMRI Study of Mathematical Ability in Third Grade Children.  
 51. FIELDS, JA Increased Posterior Cingulate Connectivity in Mild Cognitive Impairment: Evidence for a Biomarker of Alzheimer's Disease?  
 52. HALEY, A Neural Correlates of Midlife Hypertension.  
 53. JACOLA, L The Relationship Between Verbal IQ and Language Lateralization in Children with Epilepsy.  
 54. KOHL, AD The Neural Correlates of Mental Fatigue: A Comparative Study between Multiple Sclerosis and Traumatic Brain Injury.  
 55. LONG, SF Functional Connectivity of Entorhinal Cortex in Alzheimer's Disease.  
 56. MCDONALD, BC Medial Temporal Lobe fMRI Activation During Episodic Memory Processing in Children.  
 57. PERRINE, K Co-Registration of fMRI, Wada Testing, and Cortical Stimulation in Patients with Epilepsy.  
 58. PLENGER, P Functional Near Infrared Spectroscopy (fNIRS) Correlates of Recovery of Executive Functioning Following TBI: A Preliminary Analysis.  
 59. SARCENT, KN Analysis of Head Movement in MRI Training and Subsequent fMRI Scans.  
 60. SCHALLMO, M Papez Circuit Activation Observed with Functional Imaging During Semantic List Learning in Controls.  
 61. SMITH, DM Pilot: Using fMRI and neuropsychological tests to index brain function and intellectual abilities following a history of multiple concussions.  
 62. SWEET, LH Brain Response to Smoking Cues and Relationships to Severity of Nicotine Dependence.  
 63. WEISSER, V Neuroimaging in Neuropsychology: Is One Signal Enough?

### Imaging (Structural)

64. BRAHMACHARI, R Cingulate Gyus Volume and Emotional/Behavioral Problems: A Structural MRI Study.  
 65. BURNS, TG Prefrontal Cortical Thinning in Children with Sleep Disordered Breathing Predicts Executive Dysfunction.  
 66. COBIA, D Relationships Between Cortical Thickness and Verbal Working Memory in Schizophrenia.  
 67. CORREIA, S Superior longitudinal fasciculus and working memory in CADASIL.  
 68. ELDERKIN-THOMPSON, V Does Mild Prefrontal Atrophy Affect Functioning of Healthy and Depressed Elderly?  
 69. EMERTON, BC America's next top method? Comparing voxel-based morphometry and volumetry.  
 70. ENGLAND, RL The relationship between white matter tract microstructure and personality traits: a DTI study.  
 71. JANG, JY Neuroanatomy of Empathy: Sub-lobar Volumes of Right Fronto-temporal Networks.  
 72. JURANEK, J Association Between Amygdala Volume and Self-Reported Measures of Anxiety in Children with TBI.  
 73. LEE, AK Neural Correlates of Aggression: A Voxel-Based Morphometry Study.  
 74. LOCASCIO, G Rostral Corpus Callosum Size is Associated with Motor Performance in Survivors of Childhood Leukemia.  
 75. MOLNAR, AE Orbitofrontal Volume in Relation to Executive Functioning In Dyslexia and ADHD.  
 76. PORTER, JN Cortical Maturation and Verbal Fluency in Childhood, Adolescence, and Young Adulthood.  
 77. RIMRODT, SL Neurochemical Correlates of Reading Disability in Children.  
 78. TAYLOR, JL \* Larger Hippocampi Help Expert Pilots Maintain Performance in a Flight Simulator.  
 79. TOWLER, SD White Matter Hyperintensity Quantification in T2 FLAIR MRI: A Reliability Study.  
 80. WOON, F Alcoholism does not Contribute to Hippocampal Volume Loss in Adults with Posttraumatic Stress Disorder: A Meta-Analysis.  
 81. YALLAMPALLI, R Relation of Amygdala Volume and Processing of Visually-Based Emotional Stimuli Using the Face-Emotion Recognition Task in Pediatric Traumatic Brain Injury.  
 82. YALLAMPALLI, R The Effects of Pediatric Traumatic Brain Injury on Short Term Memory Processing and Hippocampal Volume.  
 83. YAU, P Structural and Functional Brain Complications in Obese Adolescents with Type 2 Diabetes Mellitus.

### Other

84. RAMATI, A White Matter Integrity and Cognition Following Electrical Injury: A Diffusion Tensor Imaging Study.  
 85. MATEU-ROBUSTÉ, O ~~A Better Look at the Remediation of Learning Disabilities: a Cognitive and Emotional Methodology Applied in a Sample of Cases.~~  
 86. MAYORAL-RODRÍGUEZ, S ~~From Learning to Speak to Reading and Writing Acquisition: Understanding the Development of Cognitive Processing in Children.~~  
 87. PÉREZ-ALVAREZ, F ~~Neuroscience and Behavior: A New Insight for Education, Assessment and Remediation.~~  
 88. STROESCU, I Evolutionary Developmental Psychology and its Educational Implications.  
 89. TIMONEDA-GALLART, C ~~Cognition and Emotion during Childhood: Towards a New Neuropsychological Approach to the Assessment and Remediation of Learning Disabilities.~~



**Visuospatial Functions/Neglect/Agnosia**

90. VAN ZANDVOORT, M

Direct cortical stimulation of the visual cortex induced retinotopic visual hallucination consistent with hV3/V3A.

**10:00–11:30 AM****Symposium 8: Multisite Transdisciplinary Studies of Child Health and Illness****Chair: Robert Annett, Discussant: Gerard Gioia  
Marquis Ballroom C**

1. ANNETT, RD
2. ANNETT, RD
3. HOOPER, SR
4. WHITE, D
5. KRIVITZKY, L
6. BROUWERS, P
7. KRULL, KR

Multisite Transdisciplinary Studies of Child Health and Illness.  
The National Children's Study.  
Chronic Kidney Disease in Children (CKiD): Challenges and Opportunities.  
Silent Infarct Transfusion Trial for Sickle Cell Disease.  
Urea Cycle Disorders Consortium.  
Pediatric HIV/AIDS Studies.  
Childhood Cancer Survivor Study.

**10:45 AM–12:15 PM****Paper Session 8: Traumatic Brain Injury (Child)  
Marquis Ballroom A**

1. FULTON, JB
2. PRASAD, M
3. YEATES, K
4. YEATES, K
5. YALLAMPALLI, R

Cognitive predictors of academic achievement in preschool children 1 year following traumatic brain injury.  
Executive Skills Following Moderate to Severe TBI in Preschoolers and School-Aged Children.  
Longitudinal Trajectories of Post-Concussive Symptoms in Children with Mild Traumatic Brain Injuries and Their Relationship to Acute Clinical Status.  
The Home Environment as a Moderator of Psychosocial Outcomes following Traumatic Brain Injury in Young Children.  
Diffusion Tensor Imaging Analysis of the Frontal Lobes in Pediatric Traumatic Brain Injury.

**10:45 AM–12:15 PM****Invited Symposium: Principles of Experience-Dependent Rehabilitation: From Animals to Aphasia Treatment****Chair: Anastasia Raymer, Discussant: Leslie Gonzalez-Rothi  
Marquis Ballroom B**

1. RAYMER, AM
2. RAYMER, AM
3. MURRAY, L
4. EDMONDS, L
5. TURKSTRA, L

Principles of Experience-Dependent Rehabilitation: From Animals to Aphasia Treatment.  
Intensity of Treatment in Aphasia: A Systematic Review  
Complexity: Friend or Foe When Remediating Syntactic Processing Deficits in Aphasia?  
Examining Generalization and Saliency in Verb Network Strengthening Treatment (VNeST), A  
Semantic Treatment for Lexical Retrieval Impairments in Aphasia.  
Animal Research and Neurorehabilitation: Principles and Practices.

**10:45 AM–12:15 PM****Poster Session 7: Child Assessment, ADHD, LD, Autism  
Imperial Ballroom****ADHD/Attentional Functions**

1. ACOSTA, MT
2. BARNARD, H
3. BEEBE, DW
4. BUTCHER, B
5. CLERKIN, SM
6. GALLO, FJ
7. GAMINO, JF
8. GONZÁLEZ-PÉREZ, P
9. GONZALEZ-PEREZ, P
10. HALE, JB
11. JACOBSON, DA

Parent Reported Executive Function in Children with Neurofibromatosis type 1 with and without Comorbid Attention Deficits.  
\* Gene x Environment Interactions in Attention Deficit Hyperactivity Disorder.  
Attention and Sleep Disruption in Overweight 10-16 Year-old Children and Adolescents.  
Neuropsychological Constructs of Attention in Children with Nonverbal Learning Disability and Attention Deficit/ Hyperactivity Disorder.  
Testing the Efficiency and Independence of the Alerting, Orienting, and Executive Attention Networks in Children with ADHD.  
Relations between CPTs and Parent Ratings of Inattention and Hyperactivity: The Moderating Effects of IQ.  
Improved Reasoning in Children with ADHD after Strategic Memory and Reasoning Training: A Novel Intervention for Strategic Learning Impairment.  
Neuropsychological Evaluation of Executive Functions in Children and Adolescents with Attention-Deficit Hyperactivity Disorder (ADHD): A Developmental Perspective.  
Assessment of neuropsychological developmental pattern of attention in a population with Attention-Deficit Hyperactivity Disorder (ADHD).  
Development and Validation of a 15-Minute Executive Function and Behavior Rating Screening Battery for Children with ADHD.  
Regional Cortical Activation Patterns During Continuous Performance Versus Response Inhibition Tasks In Adults With ADHD Subtypes.

12. KROYZER, N  
13. LAMONICA, HM  
14. MAHONE, M  
15. MASSA, J  
16. MCNALLY, M  
17. MESMAN, GR  
18. NOGGLE, CA  
19. O'BRIEN, KM  
20. PATANKAR, S  
21. RUBIO, B  
22. SHANAHAN, M  
23. STERN, SK  
24. WASSERSTEIN, J  
25. BEETAR, JT  
26. BROOKS, BL  
27. BROOKS, BL  
28. COLE, CA  
29. ESPY, KA  
30. GIOIA, CA  
31. HELDER, EJ  
32. HILL, BD  
33. ISQUITH, PK  
34. KAUFMAN, J  
35. MARTIN, R  
36. NOGGLE, CA  
37. PROSJE, MA  
38. SCHNEIDER, JC  
39. SLONAKER, AR  
40. STUDAWAY, AR  
41. SWARTWOUT, MD  
42. TSAMIS, VJ  
43. ANDERSON, SA  
44. BERRY, LN  
45. BRUBAKER, L  
46. CANTOR, D  
47. CHAN, AS  
48. CRUZ, N  
49. FILERMAN, S  
50. GIBBS, C  
51. KANG, CH  
52. MOSTOFSKY, S  
53. NIELSEN, J  
54. NOGGLE, CA  
55. PYO, G  
56. STEPANSKY, M
- Different Aspects of Decision Making Under Uncertainty in Adolescents With and Without ADHD.  
The Comparison of Adolescent Boys and Girls with Attention Deficit Hyperactivity Disorder, Predominantly Inattentive Type.  
\* Diffusion Tensor Imaging in Children with Attention-Deficit-Hyperactivity Disorder.  
Predicting ADHD and ADHD Subtypes with WISC-IV Factor Scores.  
\* Corpus Callosum Segmental Circumference Correlates with Reaction Time in Children with ADHD but not Typically Developing Children.  
Rapid Naming Deficits in Children with ADHD-PI and ADHD-C.  
Divergent Achievement Profiles of ADHD and Bipolar Disorder.  
Visual Distraction Negatively Impacts Both Auditory and Visual Working Memory in College Students with ADHD.  
Neuropsychological Assessment of Caffeine's Effect on Attention.  
Has Methylphenidate-OROS Differential Neuropsychological Effect in ADHD Children With and Without Comorbid Disorder?: Preliminary Results.  
The Relationship between Written Expression and Executive Dysfunction in Children with ADHD.  
Patterns of DKEFS Performance Predict Reading Disability But Not ADHD.  
Profile Of BRIEF Self-report Results In Adults With ADHD.
- Assessment/Psychometrics/Methods (Child)**
- Perceptual Organization versus Perceptual Reasoning in a Clinic Sample.  
\* Base rates of low scores in pediatric neuropsychology: Part I. Prevalence of low Index scores on the Children's Memory Scale (CMS).  
\* Base rates of low scores in pediatric neuropsychology: Part II. Prevalence of low subtest scores on the Children's Memory Scale (CMS).  
Ceiling Effects in the VMI-5 and TVP among Typically Developing Children.  
Test-retest reliability for new tasks to assess executive control in preschoolers.  
Examination of Normative Symptom Reports by Non-Injured Children and Their Parents.  
Neuropsychological and Behavioral Outcomes in Children with Histories of Early Deprivation: Impact of Country of Adoption.  
The Relation of Depression and Anxiety to Measures of Executive Functioning in Children and Adolescents.  
\* Psychometric Properties of a Computer Administered Working Memory and Inhibitory Control Battery for Children.  
Modified Assessment of Visual Inspection Time in Children with Cerebral Palsy.  
\* Factor Structure of Timed Motor Examination and Relationship with IQ.  
Utility of the Clock Drawing Task on the Dean-Woodcock Neuropsychological Battery as a Cognitive Screener in a Pediatric Population.  
A Psychometrically Rigorous Examination of Pediatric Neurological Soft Signs in 8, 9, and 10 year-olds.  
Assessment of Emotional Functioning in Children with Concussion: Initial Development of a Parent and Child Measure of Mood State.  
School Psychologists' Training in Neuropsychological Assessment.  
\* A meta-analysis of neurocognitive and achievement outcomes in pediatric sickle cell disease.  
Development of a Child Memory Questionnaire for Parents and its Relation to Neuropsychological Performance.  
An Examination of the Sustained Attention Measures Postulated by the Mirsky's Attention Model for Use in Childhood.
- Autism Spectrum Disorders**
- Differentiation of Autism Spectrum Disorders from other Developmental Delays: M-CHAT Plus a Measure of Initiation of Joint Attention.  
Parenting Stress in Caregivers of Children with Autism Spectrum Disorders.  
Evidence for Selective Inhibitory Impairment in Individuals with Autism Spectrum Disorder.  
QEEG and VARETA Profiles in Autism Spectrum Disorders: Severity and Medication Correlates.  
Executive Function Deficits and Neural Discordance in Children with Autism Spectrum Disorders.  
Flexibility and Adaptive Functioning in Children with Autism Spectrum Disorders.  
BASC-2 Profiles for Children Diagnosed with Autism, Asperger's Disorder, and Pervasive Developmental Disorder-Not Otherwise Specified.  
A Neuropsychological Model for Parent Reported Sensory Abnormalities in Children with Autism.  
Theory of Mind in Agenesis of the Corpus Callosum versus High Functioning Autism.  
Contributions of Postural Knowledge and Basic Motor Skill to Dyspraxia In Autism: Suggestion of Abnormalities in Distributed Connectivity and Motor Learning.  
\* Subtypes of Autism Based on Corpus Callosum Microstructure: A Diffusion Tensor Imaging and Neuropsychological Study.  
Cortical and Subcortical Sensory-Motor Profiles in Pervasive Developmental Disorder NOS.  
Orientation Functioning of Individuals with Moderate to Severe Intellectual Disability.  
WISC-IV Profiles of Children with Autism Spectrum Disorders.

57. THEDE, LL  
Diagnostic and Treatment Needs of the Autistic Community: A Survey of Parents and Adults on the Spectrum.
- Learning Disabilities/Academic Skills**
58. ALTMANN, LJ  
Information Recall in Compensated Adult Dyslexics: Does Repetition Help?
59. ALTMANN, LJ  
Rime Neighborhood Density Effects on Rapid Automatized Naming (RAN).
60. BRAHMACHARI, R  
Insula Volume in Relation to Dyslexia: A Structural MRI Study.
61. CONSTANTINOU, M  
Neuropsychological Evidence that Special Education Works.
62. EASON, SH  
\* Reader-Text Interactions in Reading Comprehension.
63. ENGLISH, LH  
\* Executive Function Development in Spina Bifida and its Influence on Preschool and School Age Academic Outcomes.
64. GOLD, AB  
Cognitive and Behavioral Attention in Children with Math Disabilities (MD).
65. HAIN, L  
Specific Learning Disability Subtypes Across Cognitive, Achievement, and Emotional/Behavioral Domains.
66. HOWLAND, KA  
Spoken and Written Pseudoword Learning in Dyslexia: Insight into How Dyslexic Readers Form Associations Between the Phonological and Orthographic Forms of Novel Words.
67. LEVINE, TM  
Preliminary Results of an Intensive Short-term Reading Intervention for Children with Reading Disabilities and Neurofibromatosis-Type 1 (NF-1).
68. MASSA, J  
Is Greater Color Naming than Word Naming on the Stroop Useful in Diagnosing Dyslexia?
69. MATUTE, E  
Age effect on writing a story in school age Mexican children: a cluster analysis.
70. MESMAN, GR  
Shared and Divergent Predictors of Rapid Naming Abilities.
71. MORERE, DA  
Eye Movements of Deaf Readers.
72. NOGGLE, CA  
Associated Neurocognitive Profiles of Differential Learning Disabilities.
73. OSMON, DC  
Experimental Orthographic Tasks and Reading Ability: Word Jumble Task.
74. OSMON, DC  
Experimental Orthographic Tasks and Reading Ability: Pseudohomophone Task.
75. OSMON, DC  
Experimental Orthographic Tasks and Reading Ability: Homophone Task.
76. OSMON, DC  
Experimental Orthographic Tasks and Reading Ability: Word Matching Task.
77. RACHUBAR, KP  
The Role of Working Memory and Finger Representation in Single-Digit Calculation.
78. SOTOZAKI, H  
Interhemispheric Integration: No Advantage of Bilateral Presentation in General Poor Readers in a Primed Lexical Decision Task.
79. STUEBING, KK  
\* IQ is Not Strongly Related to Response to Reading Instruction: A Meta- Analytic Interpretation.
80. THOMAS, K  
Magnetoencephalography (MEG) Profiles of Learning Disorders.

**12:00–1:30 PM****Friday Lunchtime Continuing Education Seminars**  
**Refer to CE schedule for location****1:15–2:45 PM****Poster Session 8: Child TBI, Genetics, Medical/Neurological Disorders, Emotion**  
**Imperial Ballroom****Emotional Processes**

1. ALTERESCU, K  
Mechanisms Underlying the Hemispace Bias for Processing Emotional Faces.
2. CLARK, U  
Recognition of Emotional Facial Expressions in Individuals Infected with the Human Immunodeficiency Virus (HIV) Correlates with Length of HIV Infection.
3. KILLGORE, WD  
Cerebral Correlates of Amygdala Responses During Non-Conscious Perception of Affective Faces in Adolescent Children.
4. KILLGORE, WD  
Introversion is Associated with Greater Amygdala and Insula Activation During Viewing of Masked Affective Stimuli.
5. LEE, AS  
Auditory and Visual Processing of Emotions Show Divergent Neuroanatomy in Neurodegenerative Disease.
6. LEON, HM  
Emotion Processing Decrements are Related to Symptoms of Depression, Age, and Gender, but not Major Depressive Disorder or Bipolar Disorder.
7. LUTHER, E  
The Role of the Amygdala in Emotional Memory.
8. POLLARD, K  
The Effects of Chronic Distress on Cognitive Status in Older Adults.
9. SUN, X  
Individual difference of brain mechanism underlying emotional activity in children.
10. VEDERMAN, A  
Affect stimulus modality and perceptual accuracy.
11. WETHERINGTON, J  
Relationships Among Emotion, Motivation, and Exercise Behavior: Regular Exercisers' and Sedentary Individuals' Subjective and Cortical Response to Exercise Stimuli.
- Genetics/Genetic Disorders**
12. BAKER, D  
Neuropsychological Profile of a 10 year-old with Turner Syndrome: A Longitudinal Case Study with Developmental Implications.
13. BENITEZ, A  
SELP 1087G/A Polymorphism is Associated with Neuropsychological Test Performance in Older Adults with Cardiovascular Disease.

14. ~~BERNARDIN, L~~ ~~Alexander Disease: a Rare Look at the Natural Evolution and Neuropsychological Progression from Infancy to Adulthood.~~
15. BEVERSDORF, DQ Serotonin transporter genotype determines the effect of psychosocial stress on cognitive performance.
16. BLOSS, CS Genetic Variation in LRRK2 and Association with Frontal and Subcortical Brain Structure in Normal Aging, Schizophrenia, and Bipolar Disorder.
17. BLOSS, CS Scanning the Genome for Genetic Susceptibility to Neuropsychiatric Disease: Genome-Wide Association of Bipolar Disorder.
18. KATZENSTEIN, J Comparisons Among Children with Hearing Loss Secondary to a Genetic Syndrome.
19. ~~L, X~~ ~~Familial Risks for Anxiety Among Siblings Based on Hospitalizations in Sweden.~~
20. MARCUS, DJ Investigating the Neuropsychological Outcomes of Pediatric Mitochondrial Disorders within a Neurodevelopmental Framework.
21. MATTIS, P Neuropsychological Functioning in Patients with Dystonia and Non-manifesting Carriers of the DYT1 and DYT6 genes.
22. MCNALLY, M Cognitive and Adaptive Functioning in the Common *MeCP2* Mutations in Rett Syndrome.
23. SCHATZ, J Preterm birth and language development in young children with sickle cell disease.
24. SCHIABOR, KM Large Scale Candidate Gene Association of Personality Profiles in Healthy Women and Women with Eating Disorders.
25. STIEHLER, BJ Cognitive Deficits in Memory for a Middle-Aged Sample of Apolipoprotein E (APOE)  $\epsilon 44$  Individuals: Findings from the Seattle Longitudinal Study.
26. WAHLSTROM, D \* Advantageous Decision-Making on the Basis of Prior Experience: Modulation by the DRD2 Taq1A Allele in Healthy Adolescents.
27. YOUNG, KM Visuospatial Weaknesses in Children with Neurofibromatosis Type 1 (NF-1).
- Learning Disabilities/Academic Skills**
28. ERICKSON, RL CVLT-II List Learning in Agenesis of the Corpus Callosum.
- Other**
29. ANDERSON, CR The Influence of Cytokines on Cognition in a Young, Healthy Population.
30. ARETOULI, E Insights into the Relationship of Theory of Mind and Executive Functioning: Evidence from Patients with Frontotemporal Dementia.
31. AUSTRIA, EL Cognitive Deficits in Shunted Hydrocephalus Persist into Adulthood.
32. AUSTRIA, EL Memory and Functional Independence in Childhood Hydrocephalus.
33. BANKS, MS Comparison Study of Two Teenage Athletes with Post-Concussion Syndrome: Can We Trust the Scans?
34. EL-MESSIDI, L The Relation of Etiology and Shunting in Early Hydrocephalus: Effects on Cognitive Functioning.
35. CAVEN, JM Bobwhite Hatchlings as Subjects for Developmental Psychoacoustics.
36. GOLDSCHMIED, J The Effects of Sleepiness in Obstructive Sleep Apnea.
37. KORKMAN, M Effects of Gender in Normal Children on NEPSY-II Attention Subtest Scores.
38. LEVY, MC Behavioral Problems in Children with Duchenne Muscular Dystrophy and Parental Stress.
39. LIM, J \* Behavioural Profiles of Infants Born Very Preterm.
40. LIM, J Behavioural Manifestations of Executive Dysfunction in Children Born Very Preterm.
41. MCMANUS, SM Neuropsychological Profile of a 7-year-old boy with Nephrogenic Diabetes Insipidus.
42. MCMANUS, SM Neuropsychological Profile of a Series of Brothers with Familial Mitochondrial Disease.
43. OLIVEIRA, MD Rhombencephalosynapsis: Neurocognition and Mood.
44. RAZ, S A Dose-Response Relationship Between Intrauterine Growth and Neuropsychological Outcome in the Very Preterm Infant.
45. ROY, S Tool Grasping for Use Requires Manipulation but not Function Tool Knowledge.
46. SPENCER-SMITH, M Childhood Brain Insult: An Earlier Age of Onset Predicts a Worse Outcome.
47. SPITZNAGEL, M The Effects of 53-hours Sleep Deprivation and Acute Cold Exposure on Cognitive Function.
48. WALZ, NC Social Information Processing in Formerly Institutionalized Chinese and Eastern-European Adopted Girls.
49. ZABEL, TA Neuropsychological outcomes following acquired obstructive hydrocephalus and endoscopic third ventriculostomy: Three adolescent case reports.
- TBI (Child)**
50. CHAPMAN, LA Clinically Significant Behavior Problems During the Initial 12 Months Following Early Childhood TBI.
51. COLE, WR Impact of a Family Intervention for Adolescent Brain Injury on Behavior and Executive Functioning: Two Case Studies.
52. EWING-COBBS, L \* Traumatic Brain Injury and Developmental Changes in Limbic and Association Pathways: A Diffusion Tensor Imaging Study.
53. GIOIA, CA Clinical Validation of a Computer Administered Pediatric Cognitive Test Battery for Children with Mild TBI.
54. HAARBAUER-KRUPA, J Traumatic Brain Injuries in Preschool Children: High Risk for Consequences and Disparities in Identification.
55. HAJEK, C Parent-Child Agreement in Ratings of Post-concussive Symptoms Following Mild Traumatic Brain Injury.

56. HALLDORSSON, JG Pediatric Traumatic Head Injuries: The Prognostic Value of Injury Severity, Location of Traumatic Event, and Age at Injury Four Years Post-Injury.
57. ISQUITH, PK Clinical Utility of a Computer Administered Working Memory and Inhibitory Control Battery for Children with Concussion.
58. KRAMER, ME Neural Correlates of Social Information Processing in Pediatric Traumatic Brain Injury.
59. KRAMER, ME Verbal Associative Memory Following Childhood Traumatic Brain Injury: an fMRI Study.
60. MARK, EM Home and Parent Predictors of Pragmatic Language Following Early Childhood TBI.
61. MCCANN, S Examination of Attention-Deficit/Hyperactivity Disorder (ADHD) Symptom Ratings and Attention Test Performance in Childhood Traumatic Brain Injury (TBI) and ADHD: Evidence for TBI Subgroups.
62. MCCAULEY, SR Incentive Effects on Time-Based Prospective Memory Performance in Children and Adolescents with Traumatic Brain Injury.
63. MERKLEY, T Cortical Thinning With Age Progression for Traumatically Brain Injured and Typically Developing Children.
64. MICKLEWRIGHT, JL Authoritarian Parenting Styles Partially Mediate the Relationship Between Parental Stress and Child Adaptive Outcomes Following Pediatric Traumatic Brain Injury.
65. NGO, CT \* Amygdala Volumes Facilitate Emotion Identification in Children With TBI During Recovery.
66. PARKS, L Longitudinal Changes in Ventricle Volume Following Pediatric Traumatic Brain Injury: Predictors of Cognitive Function One Year Later.
67. PAULOS, S Examining a family intervention for adolescent brain injury on parenting stress and family functioning: Two case studies.
68. POTTER, JL \* Permissiveness Parenting Style is Related to Executive Dysfunction after Brain Injury in Young Children.
69. PRASAD, M Pilot Study of a Home-Based Caregiver Focused Intervention for Very Young Children with Traumatic Brain Injuries.
70. RACHES, D \* Word Problem Solving and Attention in Children with Traumatic Brain Injury.
71. SINOPOLI, K Relations Among Mechanism of Injury, Injury Severity, Age at Injury, and Pre-morbid Behaviours in Childhood Traumatic Brain Injury.
72. WELLS, CT Sleep Problems Following Traumatic Brain Injury in Preschool Children: A Longitudinal Investigation.
73. WU, T Longitudinal Changes of the Corpus Callosum Pathways Subsequent to Traumatic Brain Injury.

**1:30–3:00 PM**

**Symposium 9: Adult Outcomes of Childhood Cancer: Emerging Transdisciplinary, Lifespan Research**  
**Chair: M. Douglas Ris, Discussant: Maureen Dennis**  
**Marquis Ballroom A**

1. REY-CASSERLY, C Adult Outcomes of Childhood Cancer: Emerging Transdisciplinary, Lifespan Research.
2. KRULL, K Neurocognitive Functions in Adult Survivors of Childhood Cancer: Assessment issues and practical implications.
3. ELLENBERG, L Neuropsychological Status in Long-Term Survivors of Childhood Brain Tumors: A Report from the Childhood Cancer Survivor Study.
4. RIS, M Adult Outcomes of Pediatric Low Grade Brain Tumors.
5. EDELSTEIN, K Adult Survivors of Childhood Medulloblastoma.
6. REY-CASSERLY, C Social, Adaptive, Intellectual, And Executive Functioning Skills In Older Adolescent and Young Adult Survivors Of Childhood Brain Tumors.

**1:30–3:00 PM**

**Paper Session 9: Attention Deficit Hyperactivity Disorder**  
**Marquis Ballroom B**

1. KELLY, KG Electrophysiological Analysis of Performance Monitoring in Preadolescents with Attention-Deficit/Hyperactivity Disorder.
2. KELSEY, K Impact of prenatal tobacco exposure on neuropsychological substrates of dimensions of ADHD.
3. FURUKAWA, E A Longitudinal Analysis of Cognitive Performance in ADHD: Group versus Individual Effects.
4. O'BRIEN, JW Neuropsychological Profile of Executive Function in Girls with ADHD.
5. MAHONE, M Regional Frontal Lobe Anomalies in Girls with ADHD.

**3:00–5:00 PM**

**Invited Debate: Cognitive/Neuropsychological Assessment is Critical for Learning Disabilities - or is it? Panelists: Alan S. Kaufman, G. Reid Lyon, Robert L. Mapou, H. Gerry Taylor**  
**Chair: Paul Cirino**  
**Marquis Ballrooms C and D**

1. CIRINO, PT Cognitive/Neuropsychological Assessment is Critical for Learning Disabilities – or is it?
2. KAUFMAN, AS Cognitive/Neuropsychological Assessment is Essential for Identifying and Treating Learning Disabilities.

3. MAPOU, RL Cognitive/Neuropsychological Assessment Makes Key Contributions to the Identification and Treatment of Learning Disabilities in Adults.
4. TAYLOR, H Cognitive/Neuropsychological Assessment has a Specific, though Limited Role in the Identification and Treatment of Learning Disabilities.
5. LYON, G Cognitive/Neuropsychological Assessment is not Important for Identifying and Treating Learning Disabilities.

**3:00–4:30 PM****Poster Session 9: Dementia  
Imperial Ballroom****Dementia (Alzheimers)**

1. AHMED, FS Prediction of Functional Independence in a Geriatric Veteran Population.
2. BALDWIN, E The Parietal Variant of Alzheimer's Disease: A Case Report.
3. CHANG, AC Measures of Frontal Lobe Function Predict Activities of Daily Living in Patients with Alzheimer's and Lewy Bodies Dementia.
4. DAVE, JB The Longitudinal Association Between Domain-Specific Cognitive Complaints and Performance in Older Adults with Normal Cognition and with Alzheimer's Disease.
5. ERCOLI, LM \* Plaque and Tangle Imaging Predicts Cognitive Decline in Nondemented Older Adults.
6. FOSTER, PS Reduced Spreading Activation of Lexical Networks in Alzheimer's Disease.
7. INSCORE, A Utility of the CERAD Boston Naming Test in Predicting Dementia Status in a VAMC Primary Care Sample.
8. KAUFMAN, DA Differentiating Semantic and Motor Perseverations in Memory Disorder Patients.
9. KESSELS, RP Errorless skill learning in people with mild-to-moderate or severe dementia and older adults.
10. MAHENDRA, N Text Reading Speed And Reading Comprehension In Healthy Older Adults And Persons With Dementia.
11. MAHENDRA, N Hearing Screenings for Older Adults With and Without Dementia: Outcomes and Clinical Implications.
12. MAHMOUD, N Effects of Dementia Patients' Decline in Daily Functioning on Various Aspects of Caregiver Burden Over a One-Year Period.
13. MARTIN, CD Dementia Rating Scale as a predictor for memory performance.
14. MASSMAN, P Significance of the Apolipoprotein E ε2 Allele in Alzheimer's Patients' Memory Functioning.
15. MCCARTNEY, RE Longitudinal Study of a Patient with the Tau R406W Mutation Causing Progressive Dementia with Bitemporal Atrophy.
16. MCDONALD, R Analysis of Verbal Fluency in Alzheimer's Dementia.
17. NOGGLE, CA ~~Predictability of Outcomes on the Independent Living Scale Based on RBANS Subtest Performance in a Sample of Patients with Cortical Based Dementing Disorders.~~
18. SEELYE, AM Episodic Memory Predictions in Persons with Amnesic and Non-amnesic Mild Cognitive Impairment.
19. SUHR, J Primacy, But Not Recency, Is Related To Executive Functioning In Older Adults Screened For Dementia.
20. TORRENCE, N Using Neuropsychological Performance to Predict Daily Functional Abilities in Patients with Alzheimer's Disease.
21. VOTRUBA, KL Patient Mood and Instrumental Activities of Daily Living in Alzheimer's Disease: Relationship between Patient and Caregiver Reports.
22. WONG, JT Changes in Daily Functional Abilities of Patients with Alzheimer's Disease.
23. YAMOUT, KZ Vascular Comorbidities and Cognitive Progression of Alzheimer's Disease.
24. ZEC, RF Constructional Praxis as Measured by the Complex Figure Copy in AD and MCI Patients Compared to Demographically-Matched Controls.

**Dementia (Subcortical, Specific Disorders, MCI, etc.)**

25. AMICK, M \* Dopaminergic Medication Dose Impacts Probabilistic Reversal Learning.
26. BARROSO, J Operationalizing aMCI Amnesic Criterion.
27. BARROSO, J Mild Cognitive Impairment (MCI): Differences in Qualitative Aspects Between Patients With and Without Verbal Fluency Impairment.
28. BARROSO, J Cognitive Impairment Characterization and Follow-up in Mild Cognitive Impairment Multiple-Domain Subtypes (MCI-MD).
29. BRITNELL, PL The Impact of Cognitive Impairment on Everyday Functioning in Parkinson's Disease.
30. BRITNELL, P Everyday Functioning in Alzheimer's Disease versus Dementia due to Parkinson's Disease.
31. CHANG, YL Analysis of Qualitative and Quantitative Features of Verbal Fluency in Healthy Aging, Mild Cognitive Impairment, and Alzheimer's Disease.
32. CHESTER, SK \* The Neural Correlates of Design Fluency Repetition Errors and Implications for the Diagnosis of Frontotemporal Dementia.
33. COPELAND, JN Clock Drawing in Parkinson's Disease Dementia and Alzheimer's Disease.
34. COTTINGHAM, ME Verbal Fluency Deficits Correlate with Memory Deficits in Non-Demented Patients with Memory Complaints: Implications for the Concept of Mild Cognitive Impairment.
35. CREAMER, SA Narrative Comprehension in Mild Cognitive Impairment: Assessing Inferences and Memory Operations with a Think-aloud Procedure.

36. CRUCIAN, GP  
37. DOODY, A  
38. EPPIG, JS  
39. FINE, EM  
40. GREENAWAY, MC  
41. HART, R  
42. JEFFERSON, A  
43. KELLEY, LP  
44. KIRSCH-DARROW, LE  
45. LAMAR, M  
46. LANE, EM  
47. LEBOWITZ, BK  
48. LEBOWITZ, BK  
49. LOPEZ, L  
50. LOPEZ, L  
51. MARCEAUX, J  
52. MCLAUGHLIN, NC  
53. MEYERSON, D  
54. MIKOS, AE  
55. MIKOS, AE  
56. MITCHELL, SM  
57. NEWMAN, A  
58. PIROGOVSKY, E  
59. RITCHIE, I  
60. RUEDA, A  
61. RYAN, KA  
62. SCHIEHSER, DM  
63. SISCO, S  
64. SNITZ, BE  
65. SOLLINGER, AB  
66. SOLOMON, AC  
67. SPENCER, M  
68. STAVITSKY, K  
69. TANNER, JJ  
70. TROSTER, AI  
71. TWAMLEY, EW  
72. YOUNG, KP  
73. BECKER, BW  
74. TRIEBEL, KL
- Disturbance in Spatial Representation in Parkinson's Disease.  
Selective and divided attention, within and between the visual and auditory modalities, of individuals aging with mild cognitive impairment.  
An Agnostic Approach to Mild Cognitive Impairment.  
Reduced Verbal Fluency For Proper Relative to Common Nouns in Parkinson's Disease.  
The Memory Support System for Mild Cognitive Impairment: Initial Results of a Randomized Control Trial.  
Intellectual Decline Predicts Global Functional Deficits in Dementia.  
Systolic function and cognitive aging in mild cognitive impairment: Preliminary results.  
Comparison of Quantification Methods for Lacune Volume.  
\* Longitudinal Change in Apathy Following Deep Brain Stimulation for Parkinson's Disease.  
Subjective Memory Complaints with and without Objective Memory Impairment: The Impact of Leukoaraiosis on Cognitive Phenotypes.  
Influence of Education on Subcortical Hyperintensities and Cognitive Outcome in Vascular Dementia.  
Impact of Reading Impairment on MCI Progression.  
\* Relationship of Suspected Reading Disorder to Prevalent MCI.  
Semantic and Phonemic Fluency in Age Consistent Memory Impairment and Mild Cognitive Impairment.  
Semantic and Phonemic Fluency as a Brief Cognitive Screening Tool.  
Cognitive profiles and early risk factors for Alzheimer's disease.  
Verbal and Non-Verbal Learning and Recall in Dementia with Lewy Bodies and Alzheimer's Disease.  
Utility of a Processing Speed Measure in Assessing for MCI.  
Declines in Word Recall and Processing Speed Following Unilateral DBS for Parkinson's Disease: A Controlled Study Using Reliable Change.  
Characterizing Verbal Fluency Declines Associated with Unilateral DBS for Parkinson's Disease.  
The Relationships Between Regional Leukoaraiosis, Brain Structure, and Cognition in Dementia.  
Use of MMSE & SLUMS in Screening for Dementia: Two Case Studies.  
Temporal Sequence Learning in Amnesic Mild Cognitive Impairment.  
\* Development of a Clinical Decision Tree for Identifying Conversion to Dementia in Older Adults.  
Clock Drawing in Healthy Aging and Mild Cognitive Impairment.  
MCI, but not AD, Patients' Neurobehavioral Symptoms are Related to Formal Service Needs Among Caregivers.  
Neuropsychological Profile of and Longitudinal Change in Amnesic and Nonamnesic Mild Cognitive Impairment.  
Differences in Healthy and Mild Memory Impaired Adults' Memory for Stories: The Effect of an Everyday Distraction.  
Availability of Neuropsychological Test Results Increases Likelihood Primary Care Providers Will Address Dementia Issues.  
Neuropsychiatric Symptoms in Parkinson's Disease with Mild Cognitive Impairment.  
\* Neuroanatomical Correlates of Episodic Memory in Huntington's Disease.  
Disentangling Frontal Behavioral Syndromes in Parkinson's Disease.  
Objective measures of sleep quality and cognitive performance in Parkinson's disease.  
The Impact of Gray and White Matter on Word Frequency of List-learning Intrusion Errors in Dementia.  
Pre-Surgical Coping, Stressors, and Affective Distress and Quality of Life Outcome after Deep Brain Stimulation for Parkinson's Disease.  
Cognitive Impairment and Decision-Making Capacity in Hospice Care Patients.  
Cognitive Slowing In Amnesic Mild Cognitive Impairment.
- Other**  
Longitudinal Analysis of Cognition in Participants with Amnesic Mild Cognitive Impairment and Poor Insight into Memory and Mood.
- Aging**  
Multivariate Models of Medical Decision-Making Capacity in the Prodromal Dementias of Alzheimer's Disease and Parkinson's Disease.

**3:15–4:45 PM**

1. MOORE, AB  
2. COPLAND, D  
3. MIKOS, AE  
4. BRAATEN, AJ  
5. CROSSON, B

**Symposium 10: Basal Ganglia and Cognition**  
**Chair: Anna Moore, Discussant: Frank Middleton**  
**Marquis Ballroom A**

- Basal Ganglia and Cognition.  
Subcortical Modulation of Language: Evidence from Stimulation of the Subthalamic Nucleus in Parkinson's Disease.  
DBS for Parkinson's: Dissection of the Effects on Cognition and Language.  
Language Impairments Following Basal Ganglia Stroke: Hold and Release Functions in Cognition.  
Do the Basal Ganglia Have a Role in Aphasia Recovery and Rehabilitation?

**3:15–4:45 PM****Paper Session 10: Epilepsy/Seizures  
Marquis Ballroom B**

1. CHEUNG, M  
Post-surgical memory function associated with left mesiotemporal functional MRI activation in patients with right temporal lobe epilepsy.
2. BARKER, MD  
Transitive Inference in Post-Surgical Patients with Temporal Lobe Epilepsy.
3. HERMANN, B  
Brain Development in New Onset Pediatric Epilepsy: A Longitudinal Study.
4. FASTENAU, PS  
Relationship Among Seizure Recurrence, Antiepileptic Drug Use, and Neuropsychological Functioning in Children Following the First Recognized Seizure.
5. PROSJE, MA  
Reassessing the Use of Line Drawings in the Wada Test: Deviation From Baseline and Seizure Laterality.

**5:15–6:15 PM****Presidential Address: Understanding Developmental Neurogenetic Disorders: A Transdisciplinary Approach  
President: Jack Fletcher  
Marquis Ballrooms C and D**

1. FLETCHER, J  
Understanding Developmental Neurogenetic Disorders: A Transdisciplinary Approach.

**6:15–6:45 PM****INS Business Meeting  
Marquis Ballrooms C and D****6:45–7:45 PM****Friday Evening Reception  
Marquis Foyer****SATURDAY, FEBRUARY 14, 2009****7:20–8:50 AM****Saturday Morning Continuing Education Seminars  
Refer to CE schedule for location****9:00–10:30 AM****Paper Session 11: Psychopathology/Neuropsychiatry: Schizophrenia  
Marquis Ballroom A**

1. OJEDA, N  
Longitudinal Cognitive Changes In Chronic Schizophrenia: The Role Of Processing Speed.
2. OJEDA, N  
The Role Of Sociodemographic, Clinical And Neuropsychological Symptoms On Quality Of Life In Chronic Schizophrenia.
3. COMBS, DR  
The Role of Neuropsychological, Social Cognition, and Symptoms in the Prediction of Social Functioning in Schizophrenia.
4. SCHRETLEN, DJ  
Confirmatory Factor Analysis Reveals a Latent Cognitive Structure Common to Schizophrenia, Bipolar Disorder, and Unaffected Adults.
5. TWAMLEY, EW  
COMT, Cognition, and Functional Capacity in Schizophrenia.

**9:00–10:00 AM****Invited Plenary: Tourette Syndrome: The Self under Siege  
Speaker: James Leckman  
Marquis Ballroom B**

1. LECKMAN, J  
Tourette Syndrome: The Self under Siege.

**9:00–10:30 AM****Poster Session 10: Adult Assessment, Forensics, Laterality  
Imperial Ballroom****Assessment/Psychometrics/Methods (Adult)**

1. AGUERREVERE, L  
Classification Accuracy of the Millon Clinical Multiaxial Inventory-III in the Detection of Malingering in Traumatic Brain Injury.
2. ARAUJO, G  
An Examination of the Validity of the Ruff-Light Trail Learning Test.
3. ATKINSON, TM  
Error Analysis in Tests Measuring Sequencing-Shifting Abilities.
4. BURROWS, CL  
Individual Differences in Performance on the Iowa Gambling Task: Effects of Knowledge and Experience on Decision Making.
5. BYLSMA, FW  
Predicting Trail Making Test Part B Completion Time.
6. BYLSMA, FW  
Time to Respond on the Boston Naming Test (BNT).
7. CAPPAS, K  
Evaluation of the Cognitive Log as a Predictive Measure of Outpatient Neuropsychological Testing.



8. CAPPS, A  
Detecting Insufficient Effort on Computer-Based Concussion Assessment Programs: A Comparison of Two Batteries.
9. COALSON, DL  
Clinical and Psychometric Properties of the New WAIS-IV Figure Weights Subtest.
10. COALSON, DL  
Clinical and Psychometric Properties of the New WAIS-IV Visual Puzzles Subtest.
11. CULLUM, M  
Telecognitive Assessment: Videoconference-based Neuropsychological Testing.
12. DEAN, P  
Validity of the Mattis Dementia Rating Scale with Culturally Older Deaf Adults.
13. DEJONG, JE  
\* A Confirmatory Factor Analysis of the California Verbal Learning Test—Second Edition (CVLT-II) in a Traumatic Brain Injury Sample.
14. DICKINSON, M  
The Flynn Effect in Neuropsychological Assessment: What a Difference a Decade Can Make.
15. DODD, JN  
Sensitivity and Specificity of the Neurobehavioral Status Examination for a HIV+ population.
16. GAVETT, R  
The IBAM Shows Strong Convergent Validity with the RAVLT in Older Adults.
17. GONZÁLEZ, MF  
Assessment of the Cognitive Overall Functioning in Patients with Severe Dementia: Validation the SMMSE into Spanish Population.
18. HEFLIN, LH  
Let's Inhibit Our Excitement: Slow Stroop Performance Indicates Neither Disinhibition nor Frontal Lobe Atrophy.
19. HILBORN, RS  
Construct Validity of the Montreal Cognitive Assessment (MoCA) in a Mixed Diagnostic Sample.
20. HISCOCK, M  
A Direct Comparison of Three Methods for Detecting Feigned Impairment.
21. HISCOCK, M  
A Paper Version of the Non-Manual Trail Making Test.
22. HOGGARTH, PA  
A Nonlinear Model of Cognitive and Sensory-Motor Test Performance Can Aid in Prediction of On-Road Driving Ability in Older Adults.
23. HOLDNACK, J  
Clinical and Psychometric Properties of the New WMS-IV Visual Working Memory Subtests.
24. HOLDNACK, J  
Clinical and Psychometric Properties of the new WMS-IV Design Memory Subtest.
25. HOLLIMON, M  
Validity of the Memory Subtests of the Repeatable Battery of Neuropsychological Status in a Mixed Population Referred for Neuropsychological Testing.
26. HORNER, MD  
Relationship Between Self-Reported Neurobehavioral Symptoms and Effort Test Performance in Veterans Screened for TBI.
27. HUMPHREYS CLARK, J  
Diagnostic Accuracy of Percent Retention Scores on RBANS Memory Subtests for the Identification of Alzheimer's Disease and Mild Cognitive Impairment.
28. INGRAM, M  
A Direct Comparison of the Green Word Memory Test and the Validity Indicator Profile.
29. IVERSON, GL  
\* Low Scores Across the WAIS-III/WMS-III Vary by Education & Intelligence.
30. KANE, KD  
NAB Naming Test: Convergent and Discriminant Validity.
31. KEISKI, MA  
Equivalence of WCST-128 and WCST-64 in Pre and Post DBS Patients with Parkinson's Disease.
32. KEY-DELYRIA, S  
The Naming to Definition Task is Not Just Testing Lexical Access.
33. KOPALD, B  
Alternate Paragraphs for the Logical Memory Subtests of the Weschler Memory Scale-III.
34. KRAYBILL, M  
Longitudinal Prediction of Functional Independence and Cognition: The Utility of a Brief Motor Programming Task.
35. KRIGBAUM, G  
A Pilot Study of the Sensitivity and Specificity Analysis of the Standard-Spanish Version of the Culture-Fair Assessment of Neuro-Cognitive Abilities (CANA) & The Mini Mental State Examination in Spanish (Examen Cognoscitivo Mini-Mental) with Population from the Dominican Republic.
36. LACRITZ, LH  
\* Normative Data for the Texas Card Sorting Test: A Brief New Executive Function Measure.
37. LACRITZ, LH  
Normative Data for the Montreal Cognitive Assessment in an Ethnically Diverse Sample.
38. MARTIN, RC  
Impaired Financial Abilities in Parkinson's Disease Patients With Cognitive Impairment.
39. MEAGER, MR  
~~Convergent Validity of CVLT-II, BVMT-R, & MMSE Within Differentiated Dementia Groups.~~
40. MILLER, J  
Diagnostic Efficiency of an Ability Focused Assessment Battery with a mixed clinical sample.
41. NOGGLE, CA  
~~Altering Factor Structures of the RBANS Based on Cortical or Subcortical Dementing Etiologies.~~
42. NOGGLE, CA  
~~Correlations between Outcomes on the Word Memory Test and RBANS Subtest Performance.~~
43. OLIVARES, T  
Recognition Performance on Learning and Memory Tasks in Patients with Relapsing-Remitting Multiple Sclerosis (MS).
44. OLIVARES, T  
Relationship of the Multiple Sclerosis Neuropsychological Questionnaire (MSNQ) to Neuropsychological and Depression Measures in Patients with Relapsing-Remitting Multiple Sclerosis.
45. PARSONS, TD  
~~Development of a Neuropsychological Battery using Virtual Environments.~~
46. PERALTA, AM  
Age Bias in Standardized Neuropsychological Measures.
47. PIERCE, C  
An Analysis of Nine Estimates of Premorbid Intellectual Abilities in a General Medical Sample.
48. POREH, AM  
Decomposition of the Trail Making Test Using One-on-One Computer Assisted Testing.
49. REED, B  
A Computer Adaptive Test Battery for Epidemiological Neurotoxicology.
50. RENTERIA, L  
The MMPI-2 and Personnel Selection: An Examination of Bias in the Screening of Hispanic Public Safety Officers.
51. ROSKOS, P  
The MMPI-2 Fake Bad Scale (FBS) in Depressed and Non-Depressed Epilepsy Patients.
52. SCHARRE, DW  
Self-Administered Gerocognitive Examination (SAGE): Validity and Reliability of a Brief Cognitive Screening Instrument for Detection of Early Dementia.
53. SILVA, LM  
Information Processing Speed and Efficiency: Associations with WAIS-III Factors.
54. STRICKER, NH  
Neuropsychological Assessment Battery: Performance after Left or Right Hemisphere Stroke.
55. VOTRUBA, KL  
Age- and Education-Based Normative Data for the Parametric Go/No-go (PGNG) Task.
56. WOON, F  
Use of Cognitive Screening Tests to Identify Cognitive Impairments in Survivors of Critical Illness.
57. WRIGHT, MJ  
Rationale, Psychometrics, and Application of the Item-Specific Deficit Approach (ISDA).
58. ZARTMAN, AL  
Utility of the Effort Index (EI) of the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) in a Heterogeneous Geriatric Sample.

**Executive Functions/Frontal Lobes**

59. WALKER, JB Application of the Oral Trail Making Test in a Mixed Movement Disorder Sample.

**Forensic Neuropsychology**

60. CURTIS, KL Classification Accuracy of the Seashore Rhythm Test and Speech Sounds Perception Test to Malingering in Traumatic Brain Injury.
61. DENBOER, J Memory for Complex Pictures (MCP)© vs. the Word Memory Test (WMT): Sensitivity and Specificity.
62. DENNEY, R Accuracy of the MMPI-2 Fake Bad Scale, Response Bias Scale, and Henry-Heilbronner Index in Detecting Definite Malingered Neurocognitive Dysfunction Among Male Criminals.
63. DODD, JN The Relationship Between the Booklet Category Test Malingering Index and Other Measures of Malingering.
64. HILSABECK, RC Utility of a Lower Cut-Off Score on Trial 1 of the Test of Memory Malingering (TOMM).
65. MARIANI, M \* Assessing insufficient effort using the yes/no recognition trial of the CVLT-II.
66. SHANDERA, AL Cross-Validation of a Test Battery for Use in the Detection of Malingered Mental Retardation.
67. STROESCU, I Response Bias in Clinical Neuropsychology: A Factor Analytic Examination of Validity Indicators in the WMT, VSVT, and MMPI-2.
68. TRONTEL, HG Face Validity of Effort Tests: Early vs. Late Warning About the Presence of Effort Tests.
69. WHITESIDE, D The Relationship Between the Personality Assessment Inventory Clinical Scales and the Test of Memory Malingering in a Mixed Clinical Sample.
70. ZAMORA, D Ethnicity and the Prevalence of Learning Disabilities in an Incarcerated Sample.

**Hemispheric Asymmetry/Laterality/Callosal Studies**

71. HARRELL, KM Proverb Comprehension in Individuals with Agenesis of the Corpus Callosum.
72. HOLCOMB, E \* Chinese and English Language Processing: A Lateralized Lexical Decision Study.
73. LEGARDY, SN Longitudinal Case Study of Agenesis of the Corpus Callosum: Child to Adult.
74. MCCABE, DL The Effect of Laterality, Emotional Processing, and Spatial Positioning on Deception Detection.
75. PACHALSKA, M Hypervocalization in Patients with Right-Hemisphere Brain Damage: Three Cases.
76. SADLER, S Interhemispheric Communication and Novel Solution Generation.
77. WHITMAN, RD Laterization Of The Remember Know Paradigm: What's Right Is Known And What's Left Is Remembered.

**Other**

78. ESKES, G Measuring the Components of Attention with the Attention Network Test: Is it Reliable?

**Stroke/Aneurysm**

79. DEMERTZIS, KH Diagnostic Validity and Clinical Utility of the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) in Acute Stroke.

**10:00–11:30 AM****Paper Session 12: Assessment  
Marquis Ballroom C**

1. BILDER, RM Neuropsychology 2.0: Leveraging Genomics, Phenomics, and the World Wide Web.
2. SCHMITTER-EDGEcombe, M Profiling Activities Of Daily Living Using Pervasive Sensing In A Smart Environment.
3. KOSMIDIS, MH Establishing the Cultural (in-)Appropriateness of Neuropsychological Tests.
4. AYR, LK Feasibility of a Virtual Analogue of the Morris Water Maze to Assess Spatial Learning in Children and Adolescents with Neurofibromatosis Type 1.
5. VAN TUBBERGEN, M Psychometrics of Neuropsychological Measures Modified for Use with Assistive Technology in Children with and without Cerebral Palsy.

**10:45 AM–12:15 PM****Paper Session 13: Psychopathology/Neuropsychiatry: Depression  
Marquis Ballroom A**

1. MCCLINTOCK, SM Global Cognitive and Memory Function in Severe Depression.
2. PATERSON, T Self-reported Depressive Symptoms Mediate the Relationship Between Cognition and Medication Adherence in Renal Transplant Patients.
3. DOTSON, V Cognitive Functioning, Brain Volumes, and a History of Elevated Depressive Symptoms: Effects of Age and Sex.
4. BASSO, MR Criterion Validity of the Cognitive Complaints Scale from the MMPI-RF in Inpatients with Major Depression.
5. MCCLINTOCK, SM Magnetic Seizure Therapy: Neurocognitive Effects of Different Stimulating Coil Orientations.

**10:45 AM–12:15 PM**

1. FILLEY, CM
2. SCHMAHMANN, JD
3. KELLY, JP
4. SMITH, EE

**Invited Symposium: Neurologic Perspectives on White Matter**  
**Chair: Christopher Filley**  
**Marquis Ballroom B**

Neurologic Perspectives on White Matter.  
Cerebral White Matter Pathways – Neuroanatomy and Principles of Organization.  
White Matter Lesions of Traumatic Brain Injury.  
White Matter Lesions: Implications for Age-Related Cognitive Decline and Dementia.

**12:30–2:00 PM**

1. STROBER, L
2. RABINOWITZ, A
3. BEENEY, J
4. BARWICK, F
5. STROBER, L

**Symposium 11: Complexities in Measuring Depression in Neurological Disorders: Are Neurovegetative Symptoms Valid?**  
**Chair: Peter Arnett, Discussant: Joseph Beeney**  
**Marquis Ballroom A**

Complexities in Measuring Depression in Neurological Disorders: Are Neurovegetative Symptoms Valid?  
Vegetative Symptoms of Depression and Fatigue in Multiple Sclerosis.  
Emotion Reserve Capacity: When do Cognition and Emotion Overlap and does it Matter?  
Patient and Significant Other Reports of Mood and Vegetative Depression Symptoms in MS.  
Measuring Depression in MS: What do our Measures Actually Tell us?

**12:30–2:00 PM**

1. LARSON, MJ
2. ELDERKIN-THOMPSON, V
3. DRANE, DL
4. CAVACO, S

**Paper Session 14: Cognitive Neuroscience**  
**Marquis Ballroom B**

Neural Time Course of Conflict Adaptation Effects on the Stroop Task.  
Biophysical Correlates of Cognition among Depressed and Nondepressed Type 2 Diabetes Patients.  
Category-Specific Recognition and Naming Deficits Following Resection of a Right Anterior Temporal Lobe Tumor in a Patient with Atypical Language Lateralization.  
Task specific involvement of striatum in perceptual-motor skill learning.

**12:30–2:00 PM**

1. BIELIAUSKAS, LA
2. SHEAR, PK
3. LACY, M
4. DONDEERS, J
5. BIELIAUSKAS, L

**Symposium 12: Becoming a Clinical Neuropsychologist, From Graduate School to Board Certification**  
**Chair: Linas Bieliauskas**  
**Marquis Ballroom C**

Becoming a Clinical Neuropsychologist, From Graduate School to Board Certification.  
Predoctoral Education and Training in Clinical Neuropsychology.  
Preparing for a Career in Clinical Neuropsychology: The Pre-doctoral Internship.  
Overview of Postdoctoral Training in Clinical Neuropsychology.  
Board Certification in Clinical Neuropsychology.

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# Abstracts Presented at the Thirty-Seventh Annual Meeting International Neuropsychological Society

February 11-14, 2009  
Atlanta, Georgia, USA

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WEDNESDAY AFTERNOON, FEBRUARY 11, 2009

**Symposium 1:  
Development of the NIH Toolbox for the  
Assessment of Neurological and Behavioral  
Function: Implications for the Clinical  
Neuropsychologist**

**Chair:** David Tulsy

**Discussant:** Ida Sue Baron

**Discussant:** Gordon Chelune

5:00–6:30 p.m.

**D.S. TULSKY, D.S. TULSKY, P. BAUER, N. CARLOZZI, B. BOROSH, S. WEINTRAUB, I. BARON & G. CHELUNE.** **Development of the NIH Toolbox for the Assessment of Neurological and Behavioral Function: Implications for the Clinical Neuropsychologist.**

**Symposium Description:** NIH has funded several new measurement initiatives to “reengineer” the research process by standardizing outcomes measures within the research community. The lack of uniformity between measures make it difficult to compare results across NIH-funded studies. A large NIH initiative to develop an assessment tool is part of the NIH Blueprint is targeting the development of a new measurement tool for use in longitudinal studies. The toolbox is designed to bring uniformity to outcomes measurement through the development of new measures for the cognitive, neuropsychological, sensory, motor, and emotional domains of functioning. The Toolbox is designed to be used across NIH-funded epidemiological studies and clinical trials. The Toolbox will span ages 3–85 and enable researchers to collect baseline data on functioning in several different areas of functioning. This symposium will focus on the NIH Toolbox cognitive and neuropsychological domains. Toolbox researchers will provide an overview of the toolbox project including the structure of the initiative, the aims, and the plans (David Tulsy), the selection, development, and initial validation efforts of new measures of cognitive/neuropsychological functioning including memory (Patricia Bauer), executive functioning and language (Beth Borosh), and working memory and processing speed (Noelle Carlozzi). The final talk (Sandra Weintraub) will provide an overview of the next steps for the Toolbox project including plans for collecting a large normative sample as well as a discussion of what neuropsychologists should know about the toolbox and how this measure will provide new opportunities for research and practice.

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**D.S. TULSKY, S. DIKMEN, R. HEATON, S. WEINTRAUB, R. HAVLIK & R. GERSHON.** **The NIH Toolbox For the Assessment of Neurological and Behavioral Function: Development of standardized measures in NIH-Funded research.**

**Objective:** The selection of outcome measures for longitudinal and epidemiologic studies vary between studies based upon several issues including the research question and the preferences of the principal investigator. NIH has become concerned about the lack of consistency of measures between studies. Hence, as part of the NIH Blueprint for Neurosciences Research, a collaboration between 16 NIH institutes and offices has launched a new initiative to develop and norm standardized assessments of cognition, emotion, motor functioning, and sensation for use in epidemiological, large longitudinal and prevention or intervention trials. The standardized measures will allow uniform data to be collected on a series of variables across NIH-funded studies. This presentation will provide an overview of the toolbox with particular focus on the development of cognitive measures.

**Participants and Methods:** Extensive literature reviews of clinical and experimental measures, expert opinions in a variety of areas including experimental and neuropsychology (45 one-on-one interviews were conducted), and survey data from over 150 professionals was obtained to guide development efforts.

**Results:** Each domain team (cognitive, emotional, sensory, and motor) identified tasks to measure a variety of functioning. For the cognitive domain, the following constructs were selected and measures representing them were identified: Executive Functioning, Memory, Processing Speed, Working Memory, Attention, and Language/Verbal Functioning. The measures are based on tasks commonly used in experimental research paradigms. Items have been developed so that the tasks will be appropriate for use across the lifespan (ages 3–85).

**Conclusions:** Initial testing on a sample of 120 individuals will allow research team to evaluate the tasks and items. A validation sample of 600 individuals will allow comparisons between the new tests and “gold standard measures” that are commonly used in clinical practice followed by a normative study with over 6000 individuals.

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**P.J. BAUER & J. DEOCAMPO. The Imitation Based Assessment of Memory.**

**Objective:** Memory is critical to maintaining continuity from past to present and also to planning and to establishment of a knowledge base. Whereas there are numerous assessments of memory, none has utility across the lifespan. The NIH Toolbox is developing the Imitation Based Assessment of Memory (IBAM) to fill this void.

**Participants and Methods:** Children as young as 3 years to seniors (N to date = 100) have participated in testing and retesting of the IBAM, and evaluation of relations between the IBAM and the Rey Auditory Verbal Learning Test (RAVLT; older children and adults only). In the IBAM, sequences of pictures ranging in length from 6 to 15 are presented and subjects reproduce the sequences in the demonstrated temporal order. In the RAVLT, a list of words is presented and subjects repeat them in any order. In both tasks, the to-be-remembered material is presented three times and a total score is derived.

**Results:** The length of the sequence that subjects are able to reproduce in temporal order increases from 6 steps at 3-4 years, to 9 steps at 5-6 years, 12 steps at 7-8 years, and 15 steps at 9-11 years and for adults. Test-retest reliability is in the acceptable to high range (e.g., magnitude of coefficients are between 0.68 - 0.90). Correlations with the RAVLT (ages 7 and older) also are acceptable to high (e.g.,  $r = .65 - .92$ ).

**Conclusions:** The IBAM is an excellent candidate as a measure of memory for children as young as 3 years to seniors. It is easy to administer and score, and demonstrates test-retest and convergent validity.

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**N.E. CARLOZZI, R. KURKOWSKI, N.D. CHIARAVALLI & D.S. TULSKY. Processing speed and working memory task development: The NIH Toolbox project.**

**Objective:** In order to design processing speed and working memory measures for use across the lifespan (ages 3-85) an extensive review of both clinical and experimental literature was conducted. Possible candidate measures were identified on the basis of ease of administration and potential use across the lifespan. The Toolbox team and NIH chose to adapt a Pattern Comparison Task (identify whether a stimulus/pattern is either the same, "yes" or "no" from another stimulus/pattern) and a List Sorting Task (size order sequencing of fruits and animals; one-list and two-list versions) for processing speed and working memory, respectively.

**Participants and Methods:** In order to examine task feasibility during the development process, as well as floor and ceiling effects, we examined 10 3-year-olds (children) and 11 high-functioning 21-30-year-olds (adults) on these tasks.

**Results:** Inspection of the data revealed: 1) range of scores for the List Sorting one-list was 0-19 (maximum 21); 2) range for List Sorting two-list from 0-12 (maximum 21); 3) an average score of 44.4 (SD = 12.3) for children and 110.8 (SD = 18.9) for adults on the Pattern Comparison task.

**Conclusions:** Testing indicated that children as young as 3 years old are able to understand the basic concepts of both tasks. Further, results indicated that the tests are sufficiently difficult for adults. Additional testing with larger samples (N=120) for pre-testing will be completed by October 2008 to further refine test development and prepare for validation testing and normative studies.

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**B. BOROSH, J. RICHLER, P. ZELAZO, D. BLITZ & R. GERSHON. Executive Functioning and Language Task Development: The NIH Toolbox Project.**

**Objective:** To design language and executive function measures for use across the lifespan (ages 3-85), an extensive review of both clinical

and experimental literature was conducted. For language assessment, a number of measures were potentially identified for selection, and picture vocabulary was ultimately selected for language assessment. Factor analyses of batteries of executive function (EF) tasks have revealed three related, yet clearly separable aspects of EF: mental set shifting, inhibitory control, and information updating and monitoring. Three EF tasks were chosen for this project because each is thought to primarily tap into one of these aspects of EF: the Dimensional Change Card Sort for set shifting, Flanker task for inhibitory control, and Self-Ordered Pointing for information updating and monitoring.

**Participants and Methods:** The goal of this development phase was to adapt the tasks to make them fit with the broader aims of the project: 1) computer administered; 2) brief; 3) child and adult versions 4) ensure that the child versions of the tasks are suitably engaging and child-friendly. The vocabulary measure will be developed as a computer-adaptive test.

**Results:** Pilot testing with EF tasks was conducted with preschoolers to help inform test development. Child and adult versions of each EF task are very similar, with the principal differences being simplified instructions and increased use of visual aids for children. An extensive vocabulary word list was developed by reviewing a number of well-respected sources, including published word lists with estimated difficulties and previously calibrated word lists with established parameters. In addition, all words went through an extensive "translatability" review to assure that any words selected for English use will also work effectively in Spanish.

**Conclusions:** Additional testing with larger samples (N=120 for pre-testing will be completed by October 2008) to further refine test development and prepare for validation testing and normative studies.

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**S. WEINTRAUB & D.S. TULSKY. The Future of the NIH Toolbox for the Assessment of Neurological and Behavioral Function: Implications for the Clinical Neuropsychologist.**

**Objective:** The Toolbox for Neurological and Behavioral Function is being developed as a contract from the National Institutes of Health. By standardizing the measurement tools to be used in NIH funded epidemiological studies, NIH will be impacting the scope of research that will be conducted. The measurement tools are being developed utilizing state-of-the-art psychometric research and will include extensive normative information. The target population will be the general population living in the community between the ages of 3 - 85. The tests will be developed in both English and Spanish.

This presentation will review the policy implications of such a large-scale measurement initiative. It will describe the data-collection efforts, the methods being used to translate the measures into Spanish, the efforts to calibrate the measures using Item Response Theory, and the planned standardization sampling methodology to ensure that nationally representative comprehensive normative information is provided for both English and Spanish language versions of all Toolbox measures.

The final presentation will discuss how and why the Toolbox will be important for clinical neuropsychologists. In addition to the epidemiological uses of the measures, the presentation will discuss the potential for utilizing the toolbox in clinical screening, intervention studies, and large clinical trials. The presentation will review the public policy implications of such a large-scale measurement initiative and how this measure could be adopted as the common measure in large center grant and consortium studies.

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## Symposium 2: Motor Imagery: a Rehabilitation Tool and its Neurophysiology

**Chair: Thamar Bovend'Eerd**

**Discussant: Janet Cockburn**

**5:00–6:30 p.m.**

**T. BOVEND'EERDT, J. COCKBURN, C. SCHUSTER, T.J. BOVEND'EERDT, H. DAWES & N. SHARMA. Motor Imagery: a Rehabilitation Tool and its Neurophysiology.**

**Symposium Description:** In the past decade the interest in motor imagery as a tool in rehabilitation has grown. There is a strong interest from clinicians, neuroscientists and patient groups. However, definitions, content of the interventions and underlying cortical mechanism remain subject of debate. This symposium will explore the neurophysiology behind motor imagery and its utility as a tool in rehabilitation. Corina Schuster will present results from a systematic literature review comparing motor imagery interventions in the fields of medicine and psychology. She presents data on the practical applicability of 43 imagery interventions.

Thamar Bovend'Eerd will present a generic model for motor imagery interventions in a neurological population. The model is based on a framework and integrates evidence from various fields and has been piloted in a group of people with neurological conditions and is currently being tested in an RCT.

Near Infrared Spectroscopy is a non-invasive method for measuring cerebral haemodynamics. Helen Dawes will present data from a study observing the combined use of measuring cortical activation, using Near Infrared Spectroscopy and muscle activation, using Electromyography, in order to discriminate between actual and imagined motor activity.

The final presentation by Nikhil Sharma utilise a multivariate analysis of an fMRI study to further explore the cortical networks involved in movement imagery compared to execution.

The findings from these individual studies highlight the need for a theoretical framework and evidence base for the content of motor imagery interventions. They stress the need for uncomplicated ways of measuring and controlling for motor imagery use and for a deeper insight in the neurological mechanisms in motor imagery in order to better understand interventions.

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**C. SCHUSTER, R. HILFIKER, O. AMFT, R. BUMBACHER, A. SCHEIDHAUER & T. ETTLIN. Comparison of Motor Imagery Techniques Described in Psychology and Medical Literature Regarding their Practical Applicability.**

**Objective:** The aim of this review was to compare motor imagery (MI) techniques from medicine and psychology regarding implementation criteria for efficient training sessions.

**Participants and Methods:** As part of a larger systematic literature review, databases for medicine and psychology (e.g. Scopus, PsycINFO) were searched in February 2007. Studies were included if the intervention was focused on learning or improving motor skills in healthy individuals or patients. Publications were analysed regarding the criteria: training location, participant position, supervision, instruction medium, frequency, timing, and structure of MI sessions.

**Results:** In psychology (24 studies) task-specific and unrelated locations were used, whereas in medicine (19 studies) familiar and task-specific locations were preferred. Participant position was not documented in 60% of all studies. Both disciplines preferred supervised sessions with standardised instructions. In psychology participants received oral or

written instructions, while patients in medicine listened to oral or recorded instructions, or combinations of oral and visual modalities. Number of MI trials per session varied between one and 50 in psychology and between one and 30 in medicine. MI was performed immediately before or after physical practice. While in medicine single-person MI sessions from two to twelve weeks were used, psychology studies preferred group sessions with only one MI training session. In both disciplines two session strategies became obvious: MI training after receiving instructions or MI training in combination with relaxation.

**Conclusions:** Literature in both disciplines lack vital details. Results indicate major differences in instruction medium, intervention duration and single-person vs. group sessions. Results suggest that current strategies in medicine require higher implementation efforts than in psychology. Further work should address optimisations of the implementation criteria.

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**T. BOVEND'EERDT, H. DAWES, C. SACKLEY & D.T. WADE. Development of a Motor Imagery Protocol for Neurological Rehabilitation Based on a Conceptual Framework.**

**Objective:** Motor imagery interventions used in rehabilitation are often complex and poorly standardized. A literature review showed a variety of motor imagery interventions used in neurological populations, employing different delivery methods with a limited set of tasks practiced, varying instructions and a wide range of imagery dosage. There was no apparent framework for protocols. Our objective was to develop and test a generic motor imagery protocol that is subject and task specific for therapists to use during neurological rehabilitation and to pilot this protocol in clinical practice.

**Participants and Methods:** Evidence from disciplines such as sports science and motor learning, and experiences from therapists were integrated to develop a conceptual framework. The motor imagery protocol was then tested in a heterogeneous neurological population in the clinic.

**Results:** The result was a protocol utilizing a framework based on motor learning principles and phased action. The protocol could be used by therapists in a wide range of patients for any skill allowing therapists to monitor the content of the imagery intervention.

**Conclusions:** This protocol offers the therapist a structure and strategy to deliver patient-specific motor imagery. It does not provide set rules but is designed to tailor the motor imagery to the patient's level and goals. The developed protocol is currently being used in a motor imagery Randomized Controlled Trial.

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**T. BOVEND'EERDT, H. DAWES, J. DIERX, A. DENNIS & H. IZADI. Primary Motor Cortex Oxygenation Changes during Overt and Imagined Movements using Near Infrared Spectroscopy.**

**Objective:** To investigate the oxygenation changes of the primary motor cortex during executed as well as imagined rhythmic hand grip using Near Infrared Spectroscopy.

**Participants and Methods:** A block design was employed with relative rest periods of 30 sec interspersed with 20 sec activation periods. The tasks included four repetitions of rhythmic overt and imagined hand squeezing performed in a semi-randomized order. Squeezing was paced at 0.5Hz using a metronome and the force output was shown on a screen in front of the subject. Electromyographic data of the wrist and elbow flexors and force outputs were recorded for off-line analysis. Two NIRS channels (inter-optode distance 4 cm) were used to monitor contra-lateral as well as ipsi-lateral primary motor cortex activation.

**Results:** Seven healthy subjects (4 female, 3 male, 5 right handed, 2 left handed, average age 30±7.1 years) were assessed. Repeated measures ANOVA for oxygenated hemoglobin ( $\mu\text{mol/l}$ ) showed an increase

during both execution and motor imagery compared to rest ( $p < 0.05$ ) and a bigger increase in the contra-lateral hemisphere compared to the ipsi-lateral hemisphere ( $p < 0.05$ ). De-oxygenated hemoglobin changes could not distinguish between rest and activation ( $p > 0.05$ ). The electromyographic data showed an activation of the wrist and elbow flexors during movement execution but not during motor imagery ( $p < 0.05$ ).

**Conclusions:** It is possible to measure oxygenation changes in the primary motor cortex during imagined as well as overt movements. However, it is not possible to distinguish between the two from the NIRS data alone. The electromyographic data confirmed the participants were actually performing imagery.

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**N. SHARMA, P.S. JONES & J.C. BARON. How do the Neural Networks during Motor Imagery (MI) Relate to those during Executed Movement (EM): a Multivariate fMRI Analysis.**

**Objective:** Many of the cognitive processes involved during movement are engaged during imagery. We recently used fMRI to clarify the involvement of BA4a & BA4p in imagery vs movement; however neural processes that overlap can elude conventional fMRI-modeling. Here we use multivariate analysis (tensor independent component analysis-TICA) to map the array of neural networks, both overlapping and distinct, involved during MI and EM.

**Participants and Methods:** Fourteen right-handed healthy volunteers (mean-age 28.4yrs) were recruited and screened (Chaotic MI Assessment). fMRI was a block-design finger-thumb opposition sequence performed using MI(+Rest) and EM(+Rest). TICA was implemented within FSL ([www.fmrib.ox.ac.uk/fsl](http://www.fmrib.ox.ac.uk/fsl)) which produces independent-components(IC) that were correlated to the task&rest and EMvsMI using a general linear model.

**Results:** TICA defined 52 IC's. Non-significant ICs & those representing artifact were excluded. Ten ICs significantly ( $p < 0.000001$ ) correlated with task, forming three 'groups' a) five ICs significantly correlated with EM>MI ( $p < 0.05-0.000001$ ), that included BA4a, PMd, Sup.Parietal and Cerebellum activation; b) four ICs correlated with both tasks equally that included bilateral SMA, PMd and Cerebellum activation; c) one component significantly correlated with MI>EM ( $p < 0.01$ ), that included contralateral BA4p, PMv and Inf.Parietal activation. Five other ICs correlated with rest.

**Conclusions:** Although the neural networks of MI & EM overlap, this study suggests important differences. Predictably networks that correlated with EM>MI involve structures implicated in corticospinal output that is largely absent during MI. However, other networks that include the mirror-neuron system & planning are equally involved during both tasks or are activated more during imagery. This multivariate analysis expands our understanding of MI and its relationship to EM.

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**Paper Session 1:  
Language**

**5:00–6:30 p.m.**

**D.P. ROELTGEN, L. ULLRICH & L. BLASKEY. Application of The Frith Model to Acquired Alexia and Agraphia.**

**Objective:** Models of alexia and agraphia commonly treat the entities separately. They usually include similar components (systems or routes), phonological and orthographic, the former for reading/spelling orthographically regular words (animal) or pseudowords (nud) and the latter for reading/spelling irregular words (tomb). Based on dissociations, most models show the systems as separate, though some connectionist

models are based primarily on phonology. An alternative approach is a hierarchical model with a phonological base that explains reading and spelling but also has components that explain dissociations. One model (Frith) was designed to explain findings in developmental dyslexia and dysgraphia. That model makes specific predictions: lexical agraphia is the most common isolated disorder. Phonological spelling (PS) predicts phonological reading (PR) but not the reverse. Impaired PR predicts impaired orthographic reading (OR) and spelling (OS), but preserved PR does not predict preserved orthographic spelling.

This presentation is an analysis of Frith's model applied to alexia and agraphia.

**Participants and Methods:** 43 consecutive patients with left hemispheric lesions read and spelled pseudowords and regular and irregular words (matched) and most completed the Wide Range Achievement Test-Revised, allowing a grade level of residual ability.

**Results:** Previously, we reported spelling results based on lesion location, chronicity and size and patient education. The current analysis of reading and spelling together confirm the predictions described above. The few exceptions are informative about lesion location, premorbid education and chronicity of lesion.

**Conclusions:** The relationships among PS, PR, OS and OR allow specific remediation recommendations.

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**J.I. BREIER, L.M. MAHER, S. SCHMADEKE, D. MEN & A.C. PAPANICOLAOU. Changes in Language-Specific Brain Activation and Response to Aphasia Therapy Using MEG.**

**Objective:** To characterize the relationship between change in language-specific brain activation and change in language function after Constraint Induced Language Therapy (CILT) using magnetoencephalography (MEG).

**Participants and Methods:** Twenty right-handed patients with chronic aphasia (mean age = 53; 14 males) due to stroke in the left MCA underwent MEG scanning during a recognition memory task for words before and after CILT. During CILT responses were limited to spoken verbal production. The primary treatment task was a dual card task. Each participant took turns either requesting a matching card from a semantic category from the other participant, or responding to that request. During MEG imaging participants recognized 5 target words in a list. Event related fields time-locked to the words were recorded and the intracranial generators of the averaged waveforms modeled as single equivalent current dipoles. Source locations were co-registered on the T1-weighted MRI.

**Results:** Number of late dipoles in superior and middle temporal, supra-marginal and inferior frontal gyri in each hemisphere was used to form an interhemispheric asymmetry index (AI) as (LEFT - RIGHT)/(LEFT + RIGHT). There was a significant difference between the pre- (AI = .37) and post- (AI = .03) CILT AIs,  $F(1,21) = 4.62, p < .04$  with an increase in activation in the left hemisphere after therapy. Change in language function, measured by correct responses during the therapy task, was not correlated with the change in left hemisphere activation, but it was correlated significantly with the degree of right hemisphere activation prior to therapy,  $r = .44, p < .04$ .

**Conclusions:** Results suggest that response to CILT is dependent on the relative engagement of the right hemisphere in language function prior to therapy.

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**M.F. DULAY, J.S. CHAPIN & R.M. BUSCH. Semantic Knowledge Loss After Surgery For Adulthood Onset Intractable Epilepsy.**

**Objective:** Semantic knowledge refers to acquisition of meanings and general facts. Surgical candidates who undergo left-sided anterior

temporal lobe resection (ATR) and those who have better presurgical semantic knowledge are at greatest risk for postsurgical decline on measures of semantic knowledge. Often patients with better presurgical semantic knowledge are those whose seizures started later in life; however, individuals with an early seizure onset can also adequately learn factual information over the course of their lives as their brains may adapt to recurrent seizures through reorganization. To date, the literature has defined later age at seizure onset as above 5, 9, or 14 years.

**Participants and Methods:** In this study, we evaluated semantic knowledge decline in 219 individuals who underwent unilateral ATR (118 left, 101 right) divided into 5 groups (seizure onset age <10, 10-19, 20-29, 30-39, or 40-60 years). Patients with impaired performance (below 9th percentile) before surgery on different measures of semantic knowledge were excluded.

**Results:** Repeated measure ANOVAs indicated significant side of surgery by age group interactions for the WAIS-III Vocabulary (e.g.,  $F[1,215]=3.7, p=0.015$ ) and Information subtests, WRAT-III Reading subtest, and Boston Naming Test. The largest declines after left-ATR were for the 40-60 year-old onset group (e.g., a group mean decline of approximately 2 standard deviations for Vocabulary level), followed by the 30-39 year-old onset group. Based on the Reliable Change Index method, between 36-62% of the 40-60 year-old onset group showed meaningful declines on the different measures of semantic knowledge.

**Conclusions:** The risk of semantic knowledge loss after ATR increases as a function of patient age at seizure onset, especially onset in middle to older adulthood. Presurgical counseling, as well as postsurgical rehabilitation referrals, could diminish the anguish associated with this likely deficit after ATR.

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#### **J. REILLY, A.D. RODRIGUEZ, M.L. MCCABE, D. BIUN & L.J. ALTMANN. Sound Symbolism as a Window into Crossmodal Perception and Language.**

**Objective:** Sound symbolism is a cross-linguistic phenomenon wherein content-free units, such as phonemes, carry meaning in some contexts. Recent work suggests that sound symbolism plays an important role in language development; however, its perceptual basis remains unclear. We recently found that healthy adults were systematic in matching pure tones to colors. We hypothesize that the perceptual basis for this mapping also extends to language.

**Participants and Methods:** In a fully-crossed within-subjects factorial design, 30 healthy young adults made yes/no judgments endorsing pairings of visual and auditory stimuli ( $n=120$ ). We varied visual stimuli by animacy (i.e., geometric objects or pseudoanimals) and hue (i.e., yellow or purple). We varied nonword auditory stimuli by phonological characteristics: high-stop (e.g., kiku) or low-continuant (e.g., volo). We randomized stimulus delivery using E-Prime 2.0.

**Results:** Participants were systematic in matching novel objects to nonwords as demonstrated by a significant 3-way interaction between visual and auditory factors ( $p=.001$ ). This interaction was such that participants endorsed the match of high-stop consonant nonwords and brightly colored novel objects, as well as low-continuant nonwords onto dark, objects. Moreover, they rejected the alternate pairings. This reflects sensitivity to individual perceptual factors as demonstrated by significant main effects for visual stimuli ( $p<.001$ ) and a marginal main effect of nonword phonology ( $p=.057$ ).

**Conclusions:** Systematic mapping of pure tones to color extends to novel objects and nonwords. This is likely the perceptual basis for sound symbolism. Further exploration of this effect may yield important information about crossmodal perception and its role in the evolution of natural language.

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#### **S.J. TLUSTOS & P. CHIU. Developmental Differences in Comprehension of Degraded Speech: A Brain Imaging Study.**

**Objective:** Acoustic distortions introduced into speech signals can make speech recognition more challenging. Research has suggested that central neurocognitive processes, such as working memory and top-down semantic processes, are recruited to aid recognition. It is less clear how these processes may change as a function of development.

**Participants and Methods:** We explored in 16 healthy adults (Mage=21.86) and 13 children (Mage=11.07) with normal hearing the neural correlates of recognition of degraded speech (i.e., noise vocoded speech) using an event-related fMRI protocol called HUSH with scanner-silent intervals to reduce scan time. Participants rested or heard short sentences across trials and pressed buttons to indicate whether they understood all the words or not. The sentences were either presented clear or digitally processed with high intelligibility (8-channels) or at a threshold intelligibility level for each participant (e.g., 6-channels). Participants were tested for word recognition accuracy of these sentences post-scan.

**Results:** Preliminary analyses using the General Linear Model (GLM) revealed that children showed generally similar patterns of brain activation as adults for recognition of degraded speech, relative to clear speech. A between-group comparison, covarying performance on post-scan word recognition ability, revealed that adults displayed higher activation in bilateral inferior frontal gyrus (BA 45, 47), left dorsolateral prefrontal cortex (BA 9), anterior cingulate and medial frontal cortex (BA 32, 8, 6), and right precentral gyrus (BA 4).

**Conclusions:** These results suggest that adults recruited more higher-order neurocognitive processes related to working memory, top-down semantic 'filling in' processes, and attention to assist in recognition of distorted speech than the children did.

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### **Paper Session 2: Traumatic Brain Injury (Adult)**

**5:00–6:30 p.m.**

#### **G. GIBSON-BEVERLY, R. NAKASE-RICHARDSON, R. HANKS & V. CLEMENT. Cognitive status at one-month post injury is the best predictor of productivity relative to other severity indices after TBI.**

**Objective:** Although early neuropsychological testing has been found to be predictive of late outcome among TBI survivors, variability exists in the methodology of how early neuropsychological status has been assessed. Evaluation after resolution of PTA excludes the most impaired patients. Early neuropsychological testing at fixed intervals post injury has been shown to be feasible and predictive of late outcome. However, exclusion of participants with partial batteries or untestable patients limits the generalizability of findings. The objective of this study is to include the most severely impaired participants traditionally excluded from other studies and evaluate the additional predictive properties of neuropsychological testing at one month post-injury in comparison to demographics (age, education) and other injury severity variables (GCS, duration of coma).

**Participants and Methods:** The study is comprised of 98 participants admitted to one of two TBI Model Systems neurorehabilitation hospitals. Participants were primarily Caucasian (52%) male (70%) with a median age of 25.46. Study participants were administered a brief neuropsychological battery during inpatient rehabilitation 1 month ( $\pm$  2 weeks) post-injury. Participants with partial batteries or who could not respond to formal testing had worst scores imputed for missing test data. Principal component analysis yielded one factor (COGFAC) accounting for 68% of variance among test scores.



**Results:** Binary logistic regression analyses revealed that COGFAC, age, and education were significant predictors of productivity status at one-year post injury with COGFAC having the largest effect size.

**Conclusions:** Cognitive status at one-month post injury contributed additional information beyond other injury severity indices (GCS, coma duration) in predicting late outcome.

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#### D. LABBE & T. NOVACK. Factors predicting return to driving following traumatic brain injury.

**Objective:** Driving has been associated with multiple aspects of community integration. Establishing predictors of return to driving following severe TBI is important to survivors and family members as a means of gauging the impact of the injury.

**Participants and Methods:** A total of 127 TBI survivors (66.7% male, 64.3% Caucasian) were interviewed at 1, 2, or 5 years post-injury. Average age and education at the time of injury was 35.2 (range 17 to 80) and 12.0 (range 5 to 20), respectively. The sample was moderately to severely injured (mean GCS score 7.3, 75.6% under 13).

**Results:** Of the total sample, 56.2% had returned to driving. Using a backward stepwise logistic regression, return to driving was examined in light of injury severity (Glasgow Coma Scale, Disability Rating Scale, Functional Independence Measure, Time from Injury Until Following Commands) and demographic variables (age, race, gender, years of education). Results indicate number of years of education, race, and scores on the Disability Rating Scale (DRS) at discharge were significant predictors of driving outcome within the first 5 years post-injury (OR: 1.34,  $p=.01$ ; 0.307,  $p=.018$ ; 0.75,  $p=.025$  respectively).

**Conclusions:** These data suggest that individuals with more years of education and better (lower) scores on the DRS are more likely to resume driving. In addition African American TBI survivors were significantly less likely to resume driving as compared to Caucasians. These results indicate that demographic factors may play a larger role in return to driving than injury severity.

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#### M.L. ETTENHOFER & N. ABELES. Predictors of Long-Term Post-Concussive Symptoms in a University Population.

**Objective:** Post-concussive symptoms (PCS) are prevalent during recovery from mild TBI, but their origins remain unclear. In the present study, multiple predictors of long-term PCS were examined in a university population.

**Participants and Methods:** Data regarding demographics, PCS, current alcohol and drug use, and history of TBI, orthopedic injuries, and psychiatric diagnoses were collected via questionnaire from 3,046 university students. Following confirmatory factor analysis (CFA) of individual PCS symptoms, predictors of overall PCS and individual symptom clusters were examined using multiple regression.

**Results:** CFA supported a 4-factor model of PCS, with somatic, affective, cognitive, and perceptual symptom clusters. Overall PCS was most strongly predicted by gender and history of depression or anxiety, with history of mild TBI being only weakly related. When examined by symptom cluster, somatic and affective symptoms were most strongly predicted by gender and history of depression, whereas cognitive symptoms were most strongly predicted by alcohol use, drug use, and history of ADHD or learning disability. Among the subsample of 274 participants with a history of mild TBI, significant predictors of overall PCS included gender, drug use, and history of depression.

**Conclusions:** PCS appear to be multi-determined, with predictors varying significantly by symptom cluster. Overall, the most prominent pre-

dictors of PCS were gender, history of psychiatric illness, and current substance use. By contrast, the influence of prior mild TBI was relatively small. Consideration of this profile of likely contributors to PCS should be useful in the assessment and treatment of individuals suffering from these symptoms.

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#### P. BREWSTER, K. LAWSON & T.J. ORNSTEIN. Executive Function, Depression/Anxiety and Return to Work in Mild TBI: Does Gender Play a Role?

**Objective:** Research has identified gender differences in cognitive function following traumatic brain injury (TBI). Further, women have been shown to recover from TBI and return to work sooner than men. However, the association among gender and cognitive and affective measures and functional outcome is not well understood. In this study we examined the effect of gender on cognition and depression/anxiety in a mild TBI sample and concurrently assessed whether these predict return to work.

**Participants and Methods:** 40 male and 40 female TBI patients, on average 15 months post-injury, were compared with healthy controls on cognitive (CVLT, Short Category Test (SCT), TMT) and affective measures (BAI, BDI, Visual Analogue Pain Scale). Functional outcome and employment status was rated based on clinical interview data.

**Results:** Factorial ANOVA identified sex differences for the SCT and TMT B only, with a significant interaction between sex and injury status on both measures. Pearson correlations identified an association between BDI, BAI and return to work.

**Conclusions:** While women with TBI showed better performance on SCT and TMT, there was no association between performance on these tasks and return to work, irrespective of gender. There were no identifiable gender differences on BAI or BDI, but these affective measures were found to relate to a return to work. At fifteen months post-injury, women show better executive processing than men. However, regardless of gender, only psychological wellbeing predicts return to work.

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#### C. SULLIVAN, L. HUTSON, R. SALERNO, K. SCHWAB & J. POOLE. Do Periodic Follow-up Evaluations Improve Long-Term Functional Outcomes after Traumatic Brain Injury (TBI)?

**Objective:** Determine whether periodic interdisciplinary evaluations in the first two years post-injury improve long-term functional outcomes after moderate to severe traumatic brain injury (msTBI).

**Participants and Methods:** Subjects were 100 veterans who previously received acute inpatient rehabilitation for msTBI at our regional center. There were two subgroups, both of whom consented to receive extra evaluations beyond standard care. Group 1 ( $n=55$ ) received one extra interdisciplinary evaluation (neuropsychology, neurology, psychiatry, and occupational) at baseline; Group 2 ( $n = 45$ ) received this extra evaluation at baseline, 6, 12 and 24 months. Both groups received comprehensive telephone interviews 5-15 years later (median 10), at ages 23-70 (median 41), assessing symptoms, functioning and life satisfaction.

**Results:** The two subgroups did not differ in injury severity, age or education. At follow-up, Group 1 had significantly worse disability ratings, neurologic complaints and anger than Group 2. Conversely, Group 2 reported significantly greater employment, productive use of time, and life satisfaction. In both groups, the 5-15 year interview identified continuing psychological and medical needs, leading to appointments with their local health care providers.

**Conclusions:** These findings suggest that periodic interdisciplinary evaluations in the first two years after msTBI may lead to reduced symptoms, enhanced functioning, and improved quality of life. Moreover,

we found that many patients with msTBI require continuing follow-up after two years. We discuss how life-long periodic assessments by neuropsychology and allied fields can provide msTBI patients with a stronger holding environment, identify problems requiring assistance, and enhance patients' enjoyment of life.

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## Poster Session 1: Aging, Cross Cultural, HIV/AIDS

5:00–6:30 p.m.

### ADHD/Attentional Functions

#### **B. RABINOVITZ, L. TANZMAN & J. HALPERIN. Motor Control Difficulties are Associated with Inattention but not Hyperactivity/Impulsivity in Preschoolers with ADHD.**

**Objective:** Deficits in motor control have frequently been noted in children with Attention-deficit/Hyperactivity Disorder (ADHD), with some data suggesting that impairments are more closely associated with inattentive than hyperactive/impulsive symptoms. This study examined several measures of fine motor abilities in preschoolers with and without ADHD. We hypothesized that those with ADHD would perform worse than typically-developing children on tests of fine motor abilities and that such impairments would be linked to severity of inattention, but not hyperactivity/impulsivity.

**Participants and Methods:** Twenty children diagnosed with ADHD-Hyperactive/impulsive type (ADHD-H/I) and 13 with ADHD-Combined type (ADHD-C), as assessed using the Kiddie-SADS, along with 56 Typically-developing comparison children (TD) were evaluated using subtests from the Sensorimotor Domain of the NEPSY and Purdue Pegboard. Parent and teacher ratings on the ADHD-RS-IV were also collected.

**Results:** The two Sensorimotor Domain subtest scores (Imitating Hand Positions and Visuomotor Precision) and three Purdue Pegboard scores (dominant, non-dominant, bilateral) were submitted to a MANOVA comparing ADHD-H/I, ADHD-C, and TD preschoolers. Those with ADHD-C, but not ADHD-H/I performed significantly more poorly than the TD group on Imitating Hand Positions, Visuomotor Precision and Purdue Pegboard, non-dominant hand (all  $p < .05$ ). Furthermore, Imitating Hand Positions and Visuomotor Precision scores were significantly ( $p < .01$ ) correlated with both parent and teacher ratings of Inattention on the ADHD-RS-IV, but not ratings of Hyperactivity/Impulsivity.

**Conclusions:** These data suggest that fine motor impairments characteristic of preschool children with ADHD are more closely linked with attentional difficulties than the gross motor anomalies manifested as hyperactivity and impulsivity.

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### Aging

#### **A.L. AUSTIN, J. SCOTT, R. ADAMS & L. MILLER. Anxiety, Depression and Specific Cognitive Domains: The Use of Brief Screening Measures to Assess a Community Dwelling Aging Sample.**

**Objective:** This retrospective study evaluated the size and unique proportion of variance anxiety and depression each shared with cognitive performance, as well as the amount of variance that anxiety accounted for above and beyond depression and the specific cognitive domains affected.

**Participants and Methods:** Participants were 220 individuals from a larger database between the ages of 65 and 89 years ( $M = 73.88$ ,  $SD =$

5.40), referred for outpatient neuropsychological assessment at the University of Oklahoma Health Sciences Center Neuropsychology Laboratory. Selection was based on completion of: Mini Mental State Examination (MMSE), Repeatable Battery for the Assessment of Neuropsychological Status (RBANS), Geriatric Depression Scale (GDS), and the State-Trait Anxiety Inventory (STAI). It was further hypothesized that anxiety and depression shared variance with measures of attention and memory.

**Results:** Hierarchical regression analyses indicated that education, gender, depression and anxiety accounted for significant variance in RBANS Total score (Adj  $R^2 = .10$ ,  $F[4, 215] = 6.77$ ,  $p < .001$ ). Depression alone was not significant, ( $\beta = -.09$ ,  $p > .05$ ). Anxiety accounted for marginal variance beyond education, gender and depression ( $\beta = -.12$ ,  $p = .08$ ; Adj  $R^2$  change =  $.01$ ,  $p = .08$ ). The RBANS Attention Index score also shared modest but significant variance with anxiety and depression (Adj  $R^2 = .14$ ;  $F(4, 215) = 10.16$ ,  $p < .001$ ).

**Conclusions:** Results indicated that anxiety, but not depression, shared marginal variance with global cognitive performance beyond education and gender. Further, depression and anxiety shared a negative relationship with attention. Clinical meaningfulness of these findings is discussed.

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#### **J.M. BAILIE, M.S. BREARTON, B. CARLISLE, K.G. POINTER, K. VANDEGRIFT, E. MANNEA, K.A. RYBALSKY & R.A. FRANK. The Utility of the Montreal Cognitive Assessment (MoCA) in Detecting Confounding Cognitive Impairments in Studies of Abnormal Aging and Olfaction.**

**Objective:** Early detection of abnormal aging associated with Parkinson's disease (PD) and Alzheimer's disease (AD) via olfactory testing has been well documented. In conjunction with other techniques we may use measures of olfaction to diagnose these diseases earlier in their course. However, traditional measures of olfaction confound cognitive impairment with loss of olfactory function. Previous attempts to disentangle these effects used batteries of neuropsychological tests to clarify the impact of impaired cognition. This study examined the utility of the Montreal Cognitive Assessment (MoCA) as a substitute for more comprehensive and time intensive neuropsychological batteries. The MoCA is an abbreviated measure of cognition which has been shown to be sensitive to cognitive impairments in PD and AD.

**Participants and Methods:** Fifty-four older adults (age range 56-95) completed a test of odor naming, odor threshold, the MoCA, as well as a comprehensive neuropsychological battery.

**Results:** The MoCA had good sensitivity (0.89) for detection of cognitive impairment as judged by the lengthier cognitive assessment but specificity was poor (0.39) when using the MoCA's recommended cut-off score of 26/30. A modified cut-off of 24/30 did not diminish sensitivity but improved specificity to a more acceptable level (0.61). As would be expected, the MoCA explained less variance on measures of olfaction than the comprehensive battery (Odor Identification: 0.25 vs. 0.44 & Odor Threshold: 0.21 vs. 0.29).

**Conclusions:** The MoCA appears to have sufficient utility and brevity to be considered as a screener for cognitive impairment in future studies investigating olfactory functioning in patients with AD and PD.

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#### **F.O. BINEY & A.P. HALEY. Hypertension Risk and Sympathetic Nervous System Reactivity.**

**Objective:** Hypertension, one of the most common human diseases, is a risk factor for late-life cognitive impairment and Alzheimer's disease.

For this reason, it is important to identify early markers of risk for hypertension. The present research examines sympathetic nervous system response to mental stress as a possible early risk marker, specifically in individuals with genetic risk for developing hypertension (FH+) individuals. FH+ individuals are predicted to have greater blood pressure and heart rate increases, and exhibit longer blood pressure and heart rate recovery times in response to mental stress compared to FH- individuals.

**Participants and Methods:** Participants included 34 normotensive (15 FH+, 19 FH-) adults. FH+ group had a family history of hypertension and FH- group had no family history. The Stroop and PASAT were used to induce mental stress. Blood pressure and heart rate were measured in one minute intervals during these tasks, and continued after the tasks were completed, until baseline heart rate and blood pressure was reached.

**Results:** With age as a covariate, the 2-way (FH status X Sex) MANOVA used to analyze blood pressure and heart rate recovery time revealed a significant interaction between sex and FH status for heart rate recovery time. FH+ women experienced longer heart rate recovery times than FH- women. No group differences in heart rate or blood pressure change were seen between the two family history groups

**Conclusions:** The current study suggests more attention should be given to studying cardiovascular health in women whose family history of hypertension puts them at risk for developing hypertension and other cardiovascular diseases.

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### C. BUIZA, U. DIAZ, M. GONZALEZ, A. ETXANIZ, L. PRIETO, E. URDANETA & J. YANGUAS. Age Relates Accurately To Reported Estimation Of Memory Abilities.

**Objective:** Age relation to memory decline in normal ageing is quite well established in the literature, but doubts persist about the nature of the relationship between age and reported memory complaints. In this study, we tried to establish whether there was any relationship between age and both objective and subjective memory.

**Participants and Methods:** A total sample of independently living 20 elderly people, 4 male and 16 female, with no diagnosis of cognitive decline and a mean age of 72.2 years old ( $sd = 7.12$ ), were assessed with the Wechsler Memory Scale – Third Edition (WMS-III) and the Memory Complaints Questionnaire (MAC-Q).

**Results:** For the statistical analysis, a Pearson correlation coefficient was calculated for the relationship between subjects' age and MAC-Q scores, and between the scores of WMS-III and MAC-Q.

First, age was negatively correlated with the value assigned by older people to their memory abilities ( $r(18) = -.610, p < .01$ ) and with their overall estimation of how their memory works ( $r(18) = -.501, p < .05$ ), as measured by the MAC-Q. Hence, the older they were, the lower the value the elderly gave to their memory performance.

Second, the comparison between WMS-III and MAC-Q scores correlated significantly. More specifically, 10 out of 13 MAC-Q items correlated to at least one WMS-III subscale, while one particular item and the MAC-Q Ability Subscale score correlated to almost every score showed in the WMS-III.

**Conclusions:** Elderly with no previous indication of cognitive decline estimated their memory abilities accurately, and this was reflected in their actual performance of memory tasks.

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### R.A. CHARLTON, T.R. BARRICK, H.S. MARKUS & R.G. MORRIS. Decline of Theory of Mind in Normal Ageing and the Relationship to Other Cognitive Functions and Brain Changes.

**Objective:** The aims of this study were to investigate age-related changes in theory of mind, and the relationship between theory of mind and both cognitive abilities and structural brain measures.

**Participants and Methods:** A cohort of 106 adults (aged 50-90 years) was recruited. Participants completed the Strange Stories theory of mind test, measures of verbal and performance intelligence, executive function and information processing speed, and had structural magnetic resonance imaging, including measurement of whole brain volume, white matter hyperintensities (WMH) and diffusion tensor imaging (DTI) of white matter integrity.

**Results:** Theory of mind ability declined with increasing age, and correlated significantly with measures of verbal and performance intelligence, executive function and information processing speed. The association between theory of mind and age remained significant when controlling for verbal intelligence, but not for performance intelligence, executive function or information processing speed. Theory of mind performance correlated significantly with DTI measures of white matter integrity, but not with WMH volume or whole-brain volume.

**Conclusions:** In this sample, theory of mind abilities decline with increasing age. This age-related decline may not be independent of other cognitive functions; and may also be particularly susceptible to changes in the integrity of white matter.

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### W. CHOU & M. HUA. Context-Induced False Recognition in Normal Elderly Individuals.

**Objective:** Contextual information plays a crucial role in our recognition memory. However, little explores the issue of context-induced false memory though researchers have observed text-induced false recognition. The concept of binding process has recently been proposed to account for effects of text- and context-related cues, and relations between these two on recognition memory. Likewise, few studies have examined the subject of the context effect on recognition memory in terms of binding process. Because of binding processing deficits evident in normal elderly individuals, it would be expected that their recognition memory functioning might be vulnerable to context effects. The present study was thus to explore issues of whether normal elderly people evidence context-induced false recognition.

**Participants and Methods:** Twenty normal healthy elderly and 29 normal healthy young adults participated in the present study. Each subject received a battery of neuropsychological tests and a visual recognition memory task involving both text and context feature information.

**Results:** The results revealed remarkable evidence of context-induced false recognition memory in normal individuals while it is not the case for their normal young adult counterparts. Performance of our normal elderly participants on the neurocognitive tests, particularly the executive and memory function ones, was also significantly poorer than that of normal young adults.

**Conclusions:** Based on the present results, it appeared that normal elderly individuals' recognition memory was vulnerable to context effects. We thus suggested that such a vulnerability might be associated with the dorsolateral prefrontal- and mesial temporal-related dysfunctioning mainly reflected by conventional neuropsychological measures.

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### M. COHEN, M.L. BENJAMIN, K.M. MCGREGOR, Y. CHANG, K.D. WHITE, C. RACKELMAN, M. SHEROD, I. LEVY, Z. ZLATAR & B. CROSSON. Dedifferentiation of Function in Older Adults During Category Member Generation.

**Objective:** Older adults demonstrate reduction in hemispheric asymmetry compared to younger adults during many cognitive tasks (Cabeza, 2002). Yet, this phenomenon has not been extensively studied during language production. Furthermore, the functional contribution of older adults' additional activity is unclear. Though many believe contralateral hemisphere activity to be a compensatory response to age-related

deterioration, Crosson et al. (2003) discussed the possibility that right frontal lobe activity is detrimental to language production and is normally suppressed by the right basal ganglia. The current investigation supports this hypothesis with evidence from changes in functional connectivity and dedifferentiation that may stem from changes in striatal dopamine modulation.

**Participants and Methods:** Twenty-two young (16-35 years old), eleven young-old (65-68), and eleven old-old (69-84) adults completed a block fMRI paradigm silently generating category exemplars (17 seconds/category; 16 categories). fMRI data were analyzed using AFNI (Cox 1996).

**Results:** Ten volumes of activity difference between old (young-old + old-old) and young adults ( $p < .005$ ; volume  $> 250$  microliters) included the right striatum, right middle frontal gyrus, posterior perisylvian areas, and right SMA. Analysis of the correlations between subjects' BOLD responses within these 10 regions revealed that, as compared to young adults, young-old participants demonstrated significantly fewer correlations (5/50 vs 23/50) while the old-old group demonstrated more (38/50 vs 23/50).

**Conclusions:** Results support the dedifferentiation hypothesis (Li et al., 2001) that age-related declines in (striatal) neuromodulation cause less-distinct cortical representations for old-old adults. However, findings from young-old adults indicate that a loss of functional connectivity precedes dedifferentiation.

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#### H.P. DAVIS & J. WEST. Age Effects on Emotion Recognition in Facial Displays: From 5 to 89 Years of Age.

**Objective:** Age has been shown to impact which emotions are correctly identified from facial displays. We hypothesized age effects would be detected for the negative emotions across the lifespan. Specifically, increased age would improve recognition in children and decrease recognition in adults except for disgust which would improve.

**Participants and Methods:** An emotion recognition task that morphs emotional facial expressions from an initial neutral expression to distinct increments of the full emotional expression was administered to 733 individuals, 5 to 89 years of age. This study assessed all 6 of Ekman's basic emotions (anger, disgust, sad, happy, fear, surprise) at 25%, 50%, 75%, and 100% of the full facial expression. Participants were divided into 3 children age groups ( $n = 251$ ; 5-9, 10-14, and 15-19) and 7 adult age groups ( $n = 482$ ; 20s, 30s, 40s, 50s, 60s, 70s, and 80s).

**Results:** Separate 3-way mixed ANOVA's were conducted on the percent of the expressions correctly identified for the children and adult ages. Age effects were detected for the children,  $F(2, 248) = 62.19$ ,  $p < .001$ , and adult ages,  $F(6, 474) = 17.82$ ,  $p < .001$ , with increasing age improving performance in the children ages and decreasing performance on the adult ages, with the exception of disgust which improved across adulthood. The greatest effects of age were detected for the 50% and 75% levels of presentation across all ages.

**Conclusions:** Age was shown to have the greatest impact on the negative emotions in both children and adults at the intermediate levels of presentation. Older adults and children were less accurate at recognition of fear, anger, and sad. Disgust recognition was impaired in children, but older adults greater than 60 years of age were significantly more accurate than younger adults.

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#### H.P. DAVIS & K.J. KLEBE. Mediation Analysis of Tower of Hanoi Learning across the Lifespan: From 5-89 Years of Age.

**Objective:** The Tower of Hanoi (ToH) puzzle is a problem-solving task belonging to the category of puzzles known as transformation problems:

a goal must be reached through a series of moves that are controlled by procedural rules. Variables mediating the acquisition of the solution to the Tower of Hanoi (ToH) puzzle are assessed in over 1000 participants from a sample of over 4000 individuals ranging in age from 5 to 89 years.

**Participants and Methods:** Participants were administered five trials on a 3-ring ToH followed immediately by five trials on a 4-ring ToH. We examine how age and five different potential mediating variables influence the development of ToH solution strategies. The meditation variables are shifting (preservative errors in the Wisconsin Card Sort Test), inhibition (Stroop Test), updating or working memory (visual span backwards and spatial n-Back), speed of processing (choice reaction time), and fluid intelligence (Matrices from the WASI). In the current analysis the ToH dependent variable was the total number of moves across the 5 trials of the 4-ring puzzle. Participants were members of a child group (ages 5 - 17,  $n = 249$ ) or an adult group (ages 18 - 89,  $n = 810$ ).

**Results:** For both children and adults, age always has a direct effect on ToH performance except for Visual Span in children and n-Back spatial memory in adults. Age also has indirect effects on ToH performance, operating through the individual mediators for each mediator except inhibition in children and speed of processing in adults. The meditation variables accounting for the greatest proportion of age effects on ToH performance were derived from working memory task.

**Conclusions:** Our findings are consistent with the view that holding visuospatial information in consciousness while planning moves on the ToH is a critical component for optimal performance in children and adults. However, our findings also indicate several other mediation variables contribute to ToH performance.

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#### E.C. EDMONDS, S.Z. RAPCSAK, K.K. SHASTRI, E.L. GLISKY & J.C. BARTLETT. Cognitive Mechanisms of False Facial Recognition in Older Adults.

**Objective:** Previous studies of face recognition have demonstrated that older adults show heightened false alarm rates in comparison to younger individuals. One potential explanation for this age-related increase in false alarms is that older adults rely on familiarity rather than recollection when making recognition judgments. We hypothesized that older adults would show the highest false alarm rate to faces equal in familiarity to the target items.

**Participants and Methods:** Twenty healthy older adults completed a recognition memory task which involved discriminating study faces presented three times from several types of lures. Lures included 1) conjunction faces, which were synthetic faces composed of a combination of features from two study faces, 2) familiarized lures, which were faces that participants had been exposed to three times prior to presentation of the study list, and 3) new faces.

**Results:** In comparison to previous findings in younger adults, older participants had higher false alarm rates for all three types of lures. However, the effect was particularly robust for the familiarized lures. In fact, the older adults' false alarm rate for the familiarized lures did not differ significantly from their hit rate for the study faces ( $p > .05$ ).

**Conclusions:** Rejecting familiarized lures requires recollection, while conjunctions and new faces may be successfully rejected using familiarity. The high false alarm rate to familiarized lures suggests that older adults use familiarity under conditions of poor recollection or reduced memory discrimination. This tendency to rely on familiarity may reflect older adults' broader difficulty with retrieval of source or contextual information.

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**B.L. FISCHER, J.Y. CHAN, P. RAJANI, D.A. BAKER, N.Y. YASUI, S. ASTHANA & C.E. GLEASON. Semantic Fluency Patterns of Clustering and Switching in a Community Dwelling Population of Older Adults.**

**Objective:** Verbal fluency is an important measure of cognitive functioning. Recent analyses have suggested that parameters of fluency performance may provide additional information about cognitive abilities. More specifically, determining category fluency subcategories of cluster size and number of switches between clusters will further clarify executive functioning. The present study aimed to characterize the role of clusters and switches within a dementia screening battery.

**Participants and Methods:** Participants were 260 older adults who participated in neuropsychological screenings as part of the Midwest Initiative Dementia Screening project. Based on a review of their cognitive performance and a review of medical history, medication list, mood symptoms, and list of cognitive symptoms, participants were classified into diagnostic categories, ranging from cognitively healthy to confirmed dementia diagnosis. Multivariate ANOVA was utilized to identify diagnostic group differences in clusters and switches. After correcting for age, multiple regression was performed to determine the unique predictive validity of clusters and switches on group membership.

**Results:** Confirming earlier reports, cognitively impaired participants produced significantly fewer switches and smaller clusters than cognitively normal subjects. After controlling for age, total fluency significantly predicted group membership, but neither cluster size nor number of switches provided additional predictive validity.

**Conclusions:** In older populations, total fluency effectively distinguishes between cognitively healthy and impaired status. Clusters and switches do not add predictive validity to group membership. They may be more useful when assessing for subtleties of cognitive functioning.

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**J.C. GIDLEY LARSON, Y. SUCHY & M.L. KRAYBILL. The Affect of Gender on Practice in the Elderly.**

**Objective:** Research suggests that men exhibit a faster age-related decline in some neurocognitive functions than women do. The present study sought to examine the affect of gender on change in executive/motor domains over time.

**Participants and Methods:** The Behavioral Dyscontrol Scale (BDS) was administered to 27 community-dwelling participants, ages 61-85 years, at two different time points (T1 and T2) separated by a mean of 1.2 years. The BDS assessed the capacity for motor/behavioral regulation and executive functioning. The total BDS score, and the BDS factor scores (Motor Programming (MP), Environmental Independence (EI), Fluid Intelligence (FI), and Insight) from T1 and T2 were used as dependant variables.

**Results:** After covarying for age, repeated measures ANOVA for the BDS revealed a significant Time x Gender interaction [ $F(1,25)=5.495$ ;  $p=.028$ ]. More specifically, males demonstrated little change in performance from T1 to T2 [ $t(9)=.669$ ,  $p<.520$ ], while females performed significantly better in T2 than T1 [ $t(16)=-3.088$ ,  $p<.007$ ]. Follow-up analyses indicate that the change in performance for the females was primarily driven by improvement in the EI [ $t(16)=-2.426$ ,  $p<.002$ ] and Insight [ $t(16)=-2.224$ ,  $p<.042$ ] factors.

**Conclusions:** These findings demonstrate that only women exhibited the expected practice effect, suggesting that men's abilities may have declined more rapidly than women's. Alternatively, it may be that older men lose the ability to benefit from practice, while older women do not. Correspondence: *Jennifer C. Larson, M.A., Psychology, University of Utah, 310 S. 1300 E., Salt Lake City, UT 84102. E-mail: jen.larson@utah.edu*

**L. GLASS & J.J. RYAN. Contributions of Working Memory and Processing Speed to Age-related Declines of Fluid Intelligence in a Clinical Sample.**

**Objective:** Studies of healthy individuals have evaluated contributing factors to age-related declines in fluid intelligence. Salthouse (1991) and

Schretlen et al. (2000) found that when the variables of mental speed and working memory were controlled, the amount of variance in fluid intelligence due to age was significantly reduced. Similar studies using clinical samples with suspected brain dysfunction have not been conducted. The present study examines the contribution of age, processing speed, and working memory to a measure of fluid intelligence in a patient sample.

**Participants and Methods:** The sample consisted of 215 inpatients from a VA medical center. Means for age, education, and FSIQ were 50.92 years ( $SD = 12.58$ ;  $R = 25-83$ ), 12.60 years ( $SD = 2.11$ ), and 91.93 ( $SD = 14.19$ ). All participants completed fluid intelligence (i.e., Matrix Reasoning), processing speed (i.e., Coding and Symbol Search), and working memory (i.e., Spatial Span and Letter-number Sequencing) tasks as part of a neuropsychological battery. Hierarchical regression analysis was used to assess how processing speed and working memory contribute to age differences in fluid intelligence.

**Results:** Age explained 19.4% of the variance in fluid intelligence scores. After controlling for working memory and processing speed, age no longer accounted for a significant proportion of variance in fluid intelligence,  $R^2$  Change = .009,  $p = .06$ .

**Conclusions:** These results are consistent with previous research (e.g., Salthouse, 1991) in that tasks of speed and working memory reduced the amount of variance in fluid intelligence explained by age to a non-significant level.

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**Y. GOLDIN, C.I. HIRSHSON & R. HOLTZER. Gender Effects on Attention Networks in Aging.**

**Objective:** We previously showed the alerting, orienting and executive attention networks to be reliable and valid in non-demented older adults. However, to our knowledge, the question of whether gender has an effect on these attention networks in aging has not been examined. Using the Attention Network Test (ANT), we aimed to determine the effect of gender on alerting, orienting and executive attention in a community-based cohort of older adults.

**Participants and Methods:** Participants were 209 non-demented individuals (mean age=80.3years,  $SD=4.75$ ; 63% female) enrolled in the Einstein Aging Study (EAS). Inclusion criteria required that participants attained 70% or higher accuracy on the ANT. Attention network scores on the ANT (alerting, orienting, executive attention) served as the dependent measures in three separate ANOVAs. Gender served as the two-level independent variable. Analyses controlled for age, education, ethnicity, medical comorbidity, and ANT accuracy.

**Results:** Gender had a significant effect on executive attention network scores [ $F(1,208) = 3.95$ ,  $p = 0.048$ ], with males (mean=118.1,  $SD=47.53$ ) performing better than females (mean=129.6,  $SD=60.58$ ). Higher scores on this network, assessed in millisecond reaction time, are indicative of worse performance. Gender did not have significant effects on the alerting [ $F(1,208)=0.14$ ,  $p=0.709$ ] or orienting [ $F(1,208)=0.46$ ,  $p=0.497$ ] attention network scores.

**Conclusions:** Alerting, orienting and executive attention are mediated by different brain networks. Our findings suggest that gender may have differential effects on the neural substrates underlying these attention networks. Correspondence: *Yelena Goldin, M.A., Ferkhof Graduate School of Psychology, Albert Einstein College of Medicine, Yeshiva University, 1300 Morris Park Avenue, Roussou Building, Bronx, NY 10461. E-mail: VeniceYG@gmail.com*

**R. GRANT, S.A. ROGERS & D.A. LOWE. Rey-O Organization Strategy and Cognitive Impairment Among Older Adults.**

**Objective:** The Rey Complex Figure has traditionally been used to measure visuospatial abilities, but current research suggests that it also assesses organization and executive skills. This study examines the relationship between Rey-O organization and cognitive impairment among older adults.

**Participants and Methods:** 112 older adults (ages 56-104) completed a comprehensive neuropsychological battery. Rey-O organizational strategies were coded into three groups: (a) organized, (b) disorganized, and (c) perceptually distorted. Participants were also divided into three diagnostic groups: (a) normal aging, (b) mild cognitive impairment (MCI), and (c) dementia.

**Results:** There were no differences in gender or education among the three strategies, but those using a disorganized or perceptually distorted approach were significantly older than those using an organized strategy,  $F(2,97) = 3.76, p < .03$ . Chi-square procedures revealed significant differences in approach between diagnostic groups,  $X^2(4, N = 100) = 25.27, p < .0001$ . Those with normal aging were more likely to use an organized approach, whereas those with MCI or dementia were more likely to use disorganized or perceptually distorted approaches, with the greatest perceptual distortion among those with dementia.

**Conclusions:** These findings suggest that differences in Rey-O organizational strategy may be markers for the degree of cognitive impairment among older adults. The type of strategy seems to correspond to age and can be used to differentiate between age-related diagnostic groups, with those with MCI or dementia using more disorganized and perceptually distorted strategies. Therefore, the level of organization may be a good indicator of different levels of underlying cognitive decline, differentiating between normal aging, MCI, and dementia.

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**L. GUIDOTTI, M. SEIDENBERG, M. LANCASTER, A. ROSEN, Q. ZHANG, K.A. NIELSON, J.L. WOODARD, S. DURGERIAN, P. AN-TUONO & S.M. RAO. Age-related Temporal Gradient of Famous Names: A Semantic Priming Study.**

**Objective:** The notion of differential retrieval patterns for recent and remote information is referred to as a temporal gradient. Specific memory processes are associated with distinct temporal gradient patterns, and these patterns may be influenced by the presence, location, and extent of brain damage. We studied the relationship between memory age and participant age during famous name recognition in healthy younger and older adults using a semantic priming task.

**Participants and Methods:** Participants included 30 older ( $Mage=73.1, S.D.=5.41$ ) and 30 younger ( $Mage=25.53, S.D.=3.13$ ) adults who completed a semantic priming famous name recognition task. Famous names were drawn from two time epochs: Recent (Tom Cruise) and Enduring (Bob Hope). Two different famous prime:target pairings were used: Associative (Tom Cruise-Katie Holmes) and Unrelated (Mia Hamm-Katie Holmes). Recognition reaction time and accuracy were measured.

**Results:** Overall, younger participants responded faster than older participants across both time epochs, but the difference between younger and older adults was significantly greater for recent (218ms) than for enduring names (92ms). Moreover, younger adults responded significantly faster to recent associative names than to enduring associative names ( $p < .003$ ), while the converse findings were true for older adults ( $p < .001$ ). Younger participants performed significantly faster in response to unrelated prime targets than older participants across both time epochs ( $p < .001$ ). Parallel results were found for recognition accuracy.

**Conclusions:** Older adults recognize remotely learned material faster and more accurately, whereas younger adults show an advantage for recently learned information. These findings suggest evidence of a temporal gradient associated with healthy aging.

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**L. HAASE, M. WANG & C. MURPHY. fMRI activation and olfactory cross-modal recognition memory performance in older adults.**

**Objective:** Olfactory memory function is impaired in older adults and profoundly impaired in both Alzheimer's Disease and Parkinson's Disease. The underlying cortical substrate for olfactory memory dysfunction was investigated with fMRI in a cross-modal olfactory recognition

memory paradigm that was modeled after a paradigm developed by Stark and Squire (2000). That is, the study investigated associations between cross-modal olfactory recognition memory performance as subjects attempted to indicate targets and foils during fMRI scanning sessions and brain activation in 39 non-demented older adults.

**Participants and Methods:** Immediately before entering the scanner, the subject was presented 16 odors. During functional runs at 3T on a GE scanner, target and foil names of odors were presented and the subject responded via button box whether or not each name corresponded with an odor presented before the scan. Performance on the memory task was recorded as hits, misses, correct rejections and false positives and the discriminability index ( $d'$ ) was subsequently computed. ROI analysis tested the hypothesis that activation in regions involved in olfaction and recognition memory varies as a function of subjects' discriminability index.

**Results:** Results indicate that when individuals with low discriminability respond to an odor as having been previously presented (hit), they demonstrate significantly greater activation within the superior frontal gyrus, middle frontal gyrus, anterior hippocampus, posterior hippocampus, parahippocampus, amygdala, entorhinal cortex and piriform cortex relative to individuals with high discriminability.

**Conclusions:** This study suggests that patterns of cortical activation in frontal and temporal areas are associated with degree of impairment in cross-modal odor recognition memory.

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**C.I. HIRSHSON, R. HOLTZER & Y. GOLDIN. Gender Differences in Neuropsychological Test Performance in Non-Demented Older Adults.**

**Objective:** To examine the effect of gender on neuropsychological test performance in a large aged community-based cohort.

**Participants and Methods:** Participants were non-demented individuals age 70 years and older ( $N=573$ ) enrolled in the Einstein Aging Study. Neuropsychological test performance assessed at the baseline visit was used for the purpose of this study.

Individual neuropsychological tests served as the dependent measures in three separate MANOVAs that assessed the cognitive domains of attention/executive function, verbal IQ and memory. Gender served as the two-level independent variable. Analyses controlled for age, education, ethnicity, medical comorbidity, and general cognitive status.

**Results:** MANOVAs showed significant gender effects of attention/executive function [Wilks's  $L=.95, F(5, 547)=5.64, p < 0.001$ ], verbal IQ [Wilks's  $L=.90, F(4, 548)=15.7, p < 0.001$ ], and memory [Wilks's  $L=.92, F(2, 550)=25.2, p < 0.001$ ]. ANOVAs, conducted as follow-up tests with Bonferroni correction, showed significant gender differences in several neuropsychological tests. Specifically, women performed better than men on the Digit Symbol subtest [ $F(1, 551)=8.57, p=0.004$ ], Letter Fluency Test (FAS) [ $F(1, 551)=7.39, p=0.007$ ], the Category Fluency test [ $F(1, 551)=40.2, p < 0.001$ ] and the Free and Cued Selective Reminding Test [ $F(1, 551)=28.7, p < 0.001$ ]. Men scored higher than women on the Block Design [ $F(1, 551)=9.48, p=0.002$ ] and Information subtests [ $F(1, 551)=46.7, p < 0.001$ ].

**Conclusions:** The significant influence of gender on neuropsychological test performance in normal aging has important implications with respect to the use of normative data and the diagnosis of age-related cognitive disorders. Correspondence: *Chari I. Hirshson, MA, Psychology, Yeshiva University, Albert Einstein School of Medicine, 1300 Morris Park Avenue, Bronx, NY 10461. E-mail: charicohen@gmail.com*

**K.L. HOLLEY, M. SEIDENBERG, M. PRIMEAU, M. HARRINGTON, W. HOPKINSON, V. DAVIDSON-BELL, N. IKPA & B. SCHERSCHLIGT. Cognitive Status in Elderly Patients after Elective Joint Replacement.**

**Objective:** Decline in cognitive function after a major surgery occurs frequently in elderly patients, and may be due to such factors as trauma,

anesthesia, or pre-existing illnesses. To control for premorbid status, we assessed outcomes in patients scheduled for elective surgery. The purpose of this study was to determine whether nonemergent orthopedic surgery is associated with cognitive decline in elderly subjects, and to examine the correlation of such change with self-reported pain and depression.

**Participants and Methods:** Twenty-three patients scheduled for joint replacement (mean age: 71 years) were assessed preoperatively and two weeks postoperatively with the alternate forms of the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS), the Visual Analog Scale for pain, and the Geriatric Depression Scale.

**Results:** Pairwise t-tests revealed an overall significant decrease in RBANS Language, Visuospatial/Constructional, and Delayed Memory Index scores ( $t = 2.08, p < .05$ ). A decline in Total Scale score greater than six points (90% confidence interval) occurred in 48% of patients. Multiple regression analysis showed that preoperative pain was a significant predictor of change in RBANS Total scores from time 1 to time 2 ( $R^2 = .803, \text{Beta} = -.37, p < .05$ ).

**Conclusions:** Cognitive decline as measured by the RBANS Total Scale occurred in almost half of elderly orthopedic patients following elective surgery, and was predicted by preoperative pain. These findings have implications for the clinical care of elderly patients as well as for understanding the neuropsychological impact of common medical procedures. Correspondence: *Keisha L. Holley, M.S., Department of Psychology, Rosalind Franklin University of Medicine & Science, 5500 Sampson Street, #6205, Houston, TX 77004. E-mail: kholley252@hotmail.com*

#### S.M. HORNING, J. WEST, H.P. DAVIS & R.E. CORNWELL. Emotion Recognition across the Lifespan: Age and Sex Differences.

**Objective:** The present study investigated the effects of sex and age on the accuracy of emotion recognition.

**Participants and Methods:** Participants were administered the Animated Full Facial Expression Comprehension Test, which displays dynamic photographs of the primary emotions: fear, anger, sad, disgust, surprise, and happy. Participants, 251 males and 490 females, were placed into three age groups: children (5-17), adults (18-59), and older adults (60-90).

**Results:** Six two-way between-groups analysis of variance were conducted. A significant effect for age was found for the recognition of fear ( $F[2, 735] = 26.01, p = .00$ ), anger ( $F[2, 734] = 27.66, p = .00$ ), sad ( $F[2, 734] = 45.68, p = .00$ ), disgust ( $F[2, 734] = 116.37, p = .00$ ), surprise ( $F[2, 734] = 34.42, p = .00$ ), and happy ( $F[2, 734] = 2.98, p = .05$ ), with the adults outperforming older adults and children on emotion recognition, with the exception of disgust and happy. Older adults did not differ from the adults at identifying happy, were impaired for recognition of fear, anger, sadness, and surprise, and were more accurate at identifying disgust. Children were less accurate at recognition for all emotions compared to adults. A significant effect for sex was found for anger ( $F[1, 734] = 15.10, p = .00$ ), sad ( $F[1, 734] = 11.57, p = .00$ ), and disgust ( $F[1, 734] = 6.22, p = .01$ ), favoring females across all ages.

**Conclusions:** The superior performance of females across the lifespan (5-90 years) is consistent with evolutionary theories predicting more accurate emotion recognition in order to protect offspring.

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#### A.J. JAK, A. MCCAULEY, K.J. BANGEN, L. DELANO-WOOD & M.W. BONDI. Impact of Exercise on Hippocampal Volumes in Mild Cognitive Impairment.

**Objective:** Little is known in humans about the influence of physical activity on brain structural volumes and the potential of exercise to impact negative cognitive aging outcomes. Therefore, we examined the relationship between MRI-derived hippocampal volumes and self-reported daily physical activity in older adults.

**Participants and Methods:** Forty-one nondemented participants (27 cognitively normal and 14 MCI) underwent neuropsychological testing, structural MRI, and completed self-report measures of daily physical activity and exercise. Groups were comparable on gender, age, years of education, and premorbid IQ. We obtained hippocampal volumes, adjusted for whole brain volume, via manual outlining.

**Results:** The cognitively normal group reported significantly greater daily levels of physical activity than the MCI group ( $t=2.8, p=.01$ ). 63% of the cognitively normal group engaged in a high level of physical activity as compared to only 8% of those with MCI. Higher levels of exercise were associated with significantly larger hippocampal volumes within the MCI group ( $r=.63, p=.02$ ), but not in the cognitively normal group ( $r=.10, p=.64$ ). Higher levels of exercise were also related to significantly higher scores on tests of executive functioning in both the MCI and cognitively normal groups but exercise was related to higher memory performances only in the MCI group.

**Conclusions:** Results suggest that physical exercise contributes to better cognitive functioning and structural brain integrity. Our preliminary findings also support behavioral interventions, particularly regular physical activity, as a means to preserve hippocampal volumes and cognition, particularly in those individuals at high risk for dementia.

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#### M.K. JONSDOTTIR, H. THORSTEINSSON, P.V. JONSSON, V. GUDNASON & L.J. LAUNER. Age Gene/Environment Susceptibility (AGES)-Reykjavik study: Factor analysis of a neuropsychological battery in an epidemiological study of aging.

**Objective:** Factor analysis of neuropsychological data from sub-groups of older populations could reveal meaningful cognitive dissociations with implications for diagnostic criteria of dementia and MCI. We hypothesized that data from healthy and cognitively impaired participants would yield different factor structures.

**Participants and Methods:** Exploratory factor analysis (PCA, oblique rotation) of neuropsychological data from an epidemiological study of aging (Age/Gene Environment Susceptibility (AGES)-Reykjavik study) was done in two groups: 1) those who scored below a previously defined cut-off score on the MMSE and the Digit Symbol Substitution Test (impaired,  $N = 441$ ; mean age = 80.5) and 2) those who scored above the cut-off score (healthy,  $N=1219$ ; mean age = 75.2). Factors were extracted taking into account Kaiser's criterion (eigenvalue > 1), Cattell's scree test and the interpretability of the factors. Factor loadings above .40 were considered significant. The analysis in the healthy group was cross-validated by splitting the group into two equally sized groups.

**Results:** Four factors emerged but they were different in content between the two groups, in particular those factors including speed and executive tests. Moreover, correlations between factors were higher in the healthy group. Two memory factors (working memory, LTM) were similar in the two groups.

**Conclusions:** The results have implications for the interpretation of large-scale neuropsychological studies; it cannot be assumed that the underlying structure of neuropsychological data is the same in sample sub-groups. This study will be repeated with a larger data set ( $N = 5700$ ) allowing separate analysis for three groups (healthy, impaired and MCI). Correspondence: *Maria K. Jonsdottir, Ph.D., Psychological Health (Geriatrics), Landspítali University Hospital, Tungata, Reykjavik 101, Iceland. E-mail: marijon@landspitali.is*

#### E.G. KING & R.M. BAUER. Aging and Longitudinal Changes in Virtual Morris Water Maze Performance.

**Objective:** The use of human adaptations of the Morris water maze (MWM) has become more common in the neurobehavioral study of spatial navigation in older adults, due to the task's sensitivity to lesions of the hippocampal system. Consistent with theories that aging impairs the formation/retrieval of spatial knowledge acquired from direct experience in the environment, we recently found that young adults located

the invisible target in shorter distance, more often, and spent a greater proportion of their total time in proximity to the location of the removed target on the probe trial on a virtual MWM (CG Arena) than did older adults. As part of a larger research initiative, the goal of the current study was to examine changes in spatial learning and memory changes in healthy old adults at two time points separated by approximately 2 1/2 years.

**Participants and Methods:** Nine participants (Women = 5, Men = 4; Mean age = 77.44; range = 69-91) completed the same CG Arena protocol and an abbreviated NP evaluation at both time points.

**Results:** A paired samples t-test revealed that older adults located the hidden target in a longer path length at time 2 than at time 1 ( $t(8) = -2.49$ ,  $p = .037$ ,  $d = .83$ ). No other significant changes in Arena performance were noted, but exploratory data analysis revealed that almost all participants demonstrated a pattern of decreased CG Arena performance, which warrants further investigation with a larger sample. A striking absence of practice effect was noted.

**Conclusions:** Relationships between CG Arena and NP testing performance will be discussed.

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**B.P. KOESTNER, L. HARSHMAN, S. SHIVAPOUR, L.M. VAUX, C.M. NGUYEN, T.H. YAMADA, A. BECHARA & N.L. DENBURG. Difficult Decisions: Ambiguous Decision-Making Versus Risk Decision-Making in Older Adults.**

**Objective:** Our laboratory has demonstrated that approximately one-third of older individuals manifest decision-making impairments, despite intact intellect. This study sought to determine whether such decision-making defects were due to problems with decisions under ambiguity versus decisions under risk. We predicted that decisions under ambiguity are relatively more difficult for older adults.

**Participants and Methods:** Eighty older adults participated in the study ( $M=71.2$  years;  $SD=6.8$ ). We administered two tasks: the Iowa Gambling Task (IGT), a measure of “ambiguous” decisions, and the Game of Dice Task (GDT), a measure of “risky” decisions. In the IGT, the goal is to maximize profit by selecting from the advantageous decks while avoiding the disadvantageous decks. The GDT is similar to the IGT but the rules for gains and losses are more explicit in which a dice combination is selected and money is won or lost based on the probability of that outcome.

**Results:** We regressed IGT performance on age in a linear model and found that age was a significant predictor ( $R^2=.22$ ;  $p=.01$ ). By contrast, when we regressed GDT performance on age in a linear model, we found that age was a weaker predictor ( $R^2=.06$ ;  $p=.05$ ).

**Conclusions:** The results will be discussed within a neuroanatomical framework which suggests that aging of the more anterior sectors of the ventromedial prefrontal cortex (VMPC) occur at relatively earlier ages, ultimately interfering with decisions under ambiguity, whereas aging of the more posterior sectors of the VMPC occur at later ages, and interfere with decisions under risk.

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**L. KRASEAN & A.D. BAIRD. Gender and Ethnic Group Differences in Neuropsychological Test Performance in an Urban, Older Adult Population.**

**Objective:** The investigation of ethnic and gender group differences in the neuropsychological and functional test performance of older adults has gained attention in the literature, specifically differences that persist despite controlling for multiple factors, such as age and years of education. Adjusting for word-reading level appears to eliminate some group differences on neuropsychological test performance. The purpose of the present study was to investigate associations between ethnicity, gender, and neuropsychological and functional performance within a sample of older adults.

**Participants and Methods:** The sample was comprised of 121 African American and European American adults aged 65 and above referred for clinical assessment in an urban, outpatient clinical setting. Select neuropsychological and functional measures included the Boston Naming (BNT), Visual Form Discrimination (VFD), Wide Range Achievement Test-3 Reading (WRAT-3), and two Independent Living Scales subscales.

**Results:** ANCOVA showed European-American men performed significantly better than the other three demographic groups on the BNT, WRAT-3, and ILS Money Management (MM), replicating the findings of Baird et al. (2007). These findings could not be attributed to discrepancies in age, years of formal education, and severity of cognitive impairment. Unexpectedly, no score differences on the VFD were found between the four demographic groups. Demographic group differences on the BNT and ILS MM remained after covarying on the WRAT-3 reading raw score.

**Conclusions:** These results highlight the inability of oral word reading ability alone to fully explain demographic group differences on neuropsychological and functional measures; further research examining occupational status or literacy-related activity is necessary to clarify these findings.

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**J.L. KUBIK, S.E. YEUNG, T. PATERSON & W.L. THORNTON. The Impact of Health Status on Everyday Problem Solving in Older Adults.**

**Objective:** Everyday problem solving (EPS) is predictive of real world functioning. Conflicting evidence exists regarding whether EPS relies on fluid cognitive abilities that are susceptible to aging, or on crystallized knowledge that is more robust to age. Chronic illnesses that directly impact the central nervous system (CNS) have been linked to increasing age and decreased fluid cognition. We examine the effects of such illnesses to clarify the relationship between age and EPS performance.

**Participants and Methods:** Three groups of participants were compared: 78 young adults ( $M = 19.45$  yrs), 28 healthy older adults ( $M = 68.86$  yrs), and 34 older adults with CNS illness ( $M = 70.85$  yrs). Self-reported health was based on physician diagnosed illnesses. Two EPS scores were derived from participants' solutions to 16 everyday problems: (1) number of unique solutions generated, and (2) number of safe and effective solutions.

**Results:** ANOVA results indicated that young adults performed significantly better than older adults with CNS illness when the score was based on number of solutions ( $F(2, 137) = 6.683$ ,  $p = .002$ ). Healthy older adults did not differ significantly from either group. All groups performed equally well when the safety and effectiveness of solutions was considered.

**Conclusions:** CNS illnesses may lead to reduced fluid cognition as evidenced by the lower number of unique solutions generated. However, the effects of a compromised CNS are less apparent when solution effectiveness, which may depend more on accumulated knowledge, is considered. Successful EPS performance may be achieved through both fluid and crystallized cognition; additional research will help determine whether these results indicate that shift in strategy takes place with age.

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**G.J. LEE, K.J. MILLER, J. KIM & G.W. SMALL. The Longitudinal Effect of Hormone Replacement Therapy on the Cognitive Functioning of Healthy Postmenopausal Women.**

**Objective:** Estrogen has been proposed to play an important role in cognitive functioning. The present study examines the possible longitudinal effect of Hormone Replacement Therapy (HRT) in protecting postmenopausal women from the cognitive decline associated with normal aging.



**Participants and Methods:** A total of 104 healthy participants (50 women;  $M_{age}=62.19$ ,  $SD=10.07$ ) completed neuropsychological evaluations at baseline and follow-up. Participants were divided into three groups: postmenopausal women who have never used HRT ( $n=15$ ), postmenopausal women who reported 1 or more years of HRT ( $n=35$ ), and a control group of age-matched males ( $n=54$ ). Participants' relative changes in cognitive test scores were compared across the three groups.

**Results:** Significant group differences were seen in language scores (FAS, Animals, Boston Naming Test,  $F(2,97)=3.28$ ,  $p<.05$ ). HRT users improved more over time than males, whereas HRT non-users performed similar to males. Although no significant group differences were seen in verbal memory scores, relative change in HRT users' delayed verbal memory scores was positively correlated with the duration of HRT use ( $r=.34$ ,  $p<.05$ ). HRT users with more years of use improved more on measures of delayed verbal memory (Buschke-Fuld Delayed Recall, WMS-III Logical Memory II and Verbal Pairs II).

**Conclusions:** These results suggest a possible benefit of HRT use in improving the language functioning of postmenopausal women over time. In addition, the effect of HRT use on delayed verbal memory seems to be modulated by the duration of use, such that users may not see a significant improvement in their delayed verbal memory until after several years of use.

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**G.J. LEE, K.J. MILLER, J. KIM & G.W. SMALL. The Longitudinal Effect of Hormone Replacement Therapy on the Cognitive Functioning of Healthy Postmenopausal Women with the APOE-4 Genotype.**

**Objective:** The effect of Hormone Replacement Therapy (HRT) on the cognitive functioning of postmenopausal women seems to vary for women with and without the APOE-4 allele. The present study examines the longitudinal effect of HRT use on the relative decline in cognitive functioning of postmenopausal women with the APOE-4 genotype.

**Participants and Methods:** Forty-three participants (20 women;  $M_{age}=62.23$ ,  $SD=10.94$ ) with the APOE-4 genotype (3/4 or 4/4 allele) completed neuropsychological evaluations at baseline and at follow-up. Participants were divided into three groups: postmenopausal women who have never used HRT ( $n=5$ ), postmenopausal women who reported 1 or more years of HRT ( $n=15$ ), and a control group of age-matched males ( $n=23$ ). Participants' relative changes in cognitive test scores were compared across the three groups.

**Results:** Significant group differences were seen in language (FAS, Animals, Boston Naming Test,  $F(2,39)=3.29$ ,  $p<.05$ ). HRT users improved more than men, whereas HRT non-users performed similar to males. HRT users also demonstrated more improved scores on a semantic fluency task that was not included in the overall language score (Fruits and Vegetables,  $F(1,35)=4.83$ ,  $p<.05$ ), whereas the men declined on this same task. The longitudinal change in HRT users' language scores was also positively correlated with the duration of use ( $r=.52$ ,  $p<.05$ ), demonstrating more improvement in language with more years of use.

**Conclusions:** Prior research has suggested that deficits in language functioning are more pronounced in individuals with the APOE-4 allele. Thus, HRT may have a beneficial effect on language that is more marked in individuals with the APOE-4 genotype. There was no evidence that HRT benefits verbal memory in this group, which is consistent with past research suggesting that HRT only benefits verbal memory in individuals without the APOE-4 allele.

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**E.C. LERITZ, D.H. SALAT, W.P. MILBERG, C.E. CHAPMAN, L.J. GRANDE, J.L. RUDOLPH, C.E. BARBER, L.A. LIPSITZ, D.M. SCHNYER & R.E. MCGLINCHEY. Variation in Blood Pressure is Associated with Brain Structure and Cognition in African Americans.**

**Objective:** The purpose this study was to investigate how variation in three physiology measures used to gauge risk for cerebrovascular disease (CVD; blood pressure, cholesterol, and glucose) impacts brain structure and cognition in a sample of healthy, community-dwelling older African Americans, a group with a higher prevalence of CVD.

**Participants and Methods:** Forty-two older African Americans with no history of CVD diagnosis were recruited for participation in this study. All participants underwent high-resolution T1-weighted magnetic resonance imaging (MRI) for automated segmentation of several brain structures as well as diffusion tensor imaging (DTI) for examination of white matter (WM) integrity indexed by fractional anisotropy (FA). All participants additionally underwent a battery of neuropsychological tests; measures of blood pressure, serum cholesterol and glucose were also obtained.

**Results:** Stepwise regressions revealed that higher blood pressure was associated with increased left striatal volume, and with decreased FA in two regions of interest (anterior corpus callosum and whole brain). A measure of executive function (controlled oral word association) was most strongly associated with both left and right striatal volume and with right hippocampal volume, while short-delay free recall (California Verbal Learning Test) was associated with volume of the left hippocampus. No significant relationships were found between FA and neuropsychological variables, or between CVD risk variables and measures of cognition.

**Conclusions:** These data provide evidence that variation in CVD risk factors, even on a subclinical level, may contribute to alterations in neural structure and cognition in individuals without symptoms of overt CVD. In addition to having implications for the African American community, our results also highlight the importance of early detection and treatment of CVD risk. Finally, these findings shed important light on what is currently considered to be the "normal aging" process.

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**D.A. LOWE & S.A. ROGERS. AMNART's Utility as a Premorbid Estimate Among Older Adults.**

**Objective:** The ability to assess decline from premorbid levels is important for the diagnosis of cognitive impairment in older adults. There is insufficient data regarding the validity of the American version of the National Adult Reading Test (AMNART) for use as a measure of premorbid functioning with older adults. This study examines the utility and accuracy of the AMNART estimated IQ among older adults, including differences between age-related diagnostic groups.

**Participants and Methods:** 132 older adults (ages 56-104) voluntarily completed a comprehensive neuropsychological battery, with 75 subsequently being classified with normal aging, 44 with MCI, and 13 with dementia. The AMNART estimated IQ was compared to other premorbid estimates, including education level and WAIS-III Verbal IQ (VIQ), Full Scale IQ (FSIQ), and Information scores.

**Results:** T-test analyses revealed that AMNART estimated IQ was significantly higher than other premorbid estimates,  $ps < .001$ . An ANOVA indicated that the AMNART also significantly overestimated intelligence in three educational groups (0-12, 13-16, and 17+ years),  $ps < .01$ . Additionally, ANOVAs revealed that as cognitive impairment worsened, there were significantly greater discrepancies between AMNART and both VIQ and FSIQ,  $F_s(2, 120) > 13.87$ ,  $ps < .01$ .

**Conclusions:** The results suggest that the AMNART may overestimate premorbid ability relative to other tests of premorbid intelligence. There was a discrepancy between education level and AMNART IQ classification. Additionally, the discrepancy between AMNART scores and other

premorbid estimates appears to increase with greater cognitive impairment. These findings suggest that the AMNART should be used with caution and in conjunction with other estimates, lest it overestimate actual premorbid abilities and therefore risk overestimating level of cognitive decline.

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#### **D.A. LOWE & S.A. ROGERS. Do the Features of Depression Change with Advancing Age?**

**Objective:** Although research has drawn attention to the prevalence of depression among older adults, little has been done to examine differences in depression between age groups, including differences in the subtypes of depression. This study examines age-related differences in depression among older adults, including the emotional, cognitive, and physical features of depression.

**Participants and Methods:** 75 older adults (ages 56-96) who met clinical criteria for normal aging voluntarily completed a comprehensive neuropsychological battery. They were divided into 5 different age groups (50-59, 60-69, 70-79, 80-89, and 90+). Their current level of depression was assessed using the Geriatric Depression Scale (GDS), which was coded into cognitive, physical, and emotional subscales by three raters (ICC = 0).

**Results:** Age was positively correlated with overall and emotional symptoms of depression,  $ps < .05$ , but not physical or cognitive symptoms. An ANOVA showed a stepwise pattern of differences in depression between age groups, with scores that were lowest among those 50-59, intermediate among those 60-89, and highest among those 90 and over,  $p < .01$ . ANOVAs revealed a similar stepwise pattern for the emotional and physical features of depression, with higher scores among older age groups,  $ps < .05$ . There was also a trend toward lower scores on the cognitive subscale among those 50-59 years of age,  $p < .06$ .

**Conclusions:** Among older adults, depression appears to increase with age, although this is likely due to increased emotional rather than physical or cognitive symptoms. Moreover, the type and level of depression may depend upon distinct age groupings. Overall depression, as well as emotional and physical features, were lowest among those 50-59, plateaued among those 60-89, and reached the highest levels among those 90 and over. These findings shed light on the complex relationship between age and depression, with direct implications for accurately assessing, diagnosing, and treating older adults suffering from depression. Correspondence: *Deborah A. Lowe, Department of Psychology, Westmont College, 955 La Paz Road, Santa Barbara, CA 93108. E-mail: deborah.a.lowe@gmail.com*

#### **J.J. LY, G. DAMJANAC, E. BANAKOS & N.S. FOLDI. Influences of Age, Task Demands, and Practice on Attentional Capacity.**

**Objective:** A visual attention study examined how task demand impacts attentional capacity across the lifespan. We compared simple (SRT-low demand) and choice reaction time (CRT-high demand) paradigms using continuous stimulus presentations at faster (high demand) and slower (low demand) interstimulus intervals (ISI). We hypothesized that higher demands on capacity are more vulnerable with age, which can influence processing efficiency.

**Participants and Methods:** 73 healthy participants (young, 18-39yrs; middle, 40-59yrs; young-old, 60-79yrs; old-old, >80yrs) performed the SRT and CRT tasks, with stimuli presented randomly at four ISIs (350, 500, 650, 800ms). To assess practice and/or fatigue on efficiency, both tasks were administered twice, at the beginning and end of testing sessions. Standard tests of executive function and speed were used as correlates.

**Results:** The oldest group showed overall slowing, but was not, as expected, disproportionately sensitive at short ISIs compared to other groups across both tasks. The GroupXTask interaction,  $F(3,69)=3.21, p=.028, \eta^2=.12$  revealed that the young group performed faster than the two oldest group on the CRT. Strategy shifts were seen

in the old-old group on the CRT, which correlated with executive function and speed ( $p<.007$ ), and in the young group on the SRT at the fastest ISI, which correlated with executive function ( $p<.007$ ). The second administration of the SRT showed practice in all groups  $F(1,69)=7.43, p=.008, \eta^2=.10$  but not on the CRT.

**Conclusions:** As hypothesized, higher task demand strained vulnerable late-life attentional capacity and may be responsible for shifts in strategies over the lifespan. All groups benefited from practice on the low demand task, suggesting practice mostly improves perceptual and motor processing.

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#### **S. MACKIN, E. GILLUNG, E. MCKAY & P. AREAN. The Impact of Mild Cognitive Impairments on Physical Activities in the Elderly.**

**Objective:** Mild disruption in Instrumental Activities of Daily Living (IADLs) is often reported as a consequence of Mild Cognitive Impairment (MCI). Most existing studies have evaluated IADL impairment in MCI for activities that are primarily cognitively mediated but fewer studies have evaluated the impact of MCI on physical activities. The present study was conducted to evaluate the impact of MCI on physical activities in older adults.

**Participants and Methods:** 70 non-demented older adults completed measures of physical health quality of life, perceived cognitive impairment, and depression symptom severity. Cognitive status was evaluated utilizing comprehensive neuropsychological assessments and cognitive domain index scores were calculated for each participant. Cognitive impairment was defined as performance falling below the 10th percentile when referenced to age and education matched peers.

**Results:** Individuals with MCI reported significantly poorer ratings of physical health status than individuals without cognitive impairment [ $F(2, 69) = 3.21, p = .046$ ]. Ratings of perceived cognitive impairment and depression symptom severity were not statistically different for MCI and cognitively intact individuals. Results of a linear regression analysis [ $F(9, 59) = 2.81, p = .009$ ] indicated that poorer ratings of physical health status were predicted by executive deficits, perceived cognitive impairment, and depression symptom severity.

**Conclusions:** Older adults with MCI may be at risk for experiencing poorer quality of life related to physical activities than cognitively intact individuals and deficits of executive functioning appear to be particularly deleterious in this domain. Patient perception of cognitive impairment and depression symptom severity were also strong predictors of poor physical health status in this sample.

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#### **P.E. MAY, J.L. WOODARD, M.A. JOHNSON, P. MARTIN, D. HAUSMAN, R.C. GREEN, L.S. MILLER, A. DAVEY, M. BURGESS & L.W. POON. Examining Albumin, Hemoglobin, and BMI as Predictors of Cognitive Impairment in Octogenarians and Centenarians.**

**Objective:** Previous research has shown cognitive decline to be associated with malnutrition in older adults. We studied the relationships between cognitive performance and albumin, hemoglobin, and body mass index (BMI) in octogenarian and centenarian participants from the Georgia Centenarian Study.

**Participants and Methods:** Using a population-based sample, 244 centenarians (M-age=100.5 years, 21% African American; 85% female) and 80 octogenarians (M-age=84.3, 17.5% African American; 66% female) were recruited. Participants completed the Mini-Mental State Examination, Severe Impairment Battery, Fuld Object Memory Evaluation (episodic memory and right-left discrimination), Behavioral Dyscontrol Scale (executive functioning), Controlled Oral Word Association Test, motor speed assessment, and WAIS-III Similarities subscale. BMI and serum values for albumin and hemoglobin were measured.

**Results:** A series of multiple regression analyses revealed that albumin was significantly associated with all cognitive measures in both age groups. Abnormally low levels of albumin as reported for octogenarians (5%) and centenarians (26%) were significantly ( $p < .05$ ) associated with lower scores on all cognitive measures. Correlations ranged from  $r = .33$  to  $.40$  and  $r = .18$  to  $.37$  in octogenarians and centenarians, respectively (all  $p$ 's  $\leq .008$  or less). Neither hemoglobin nor BMI were consistently associated with cognitive performance; low levels of hemoglobin were only significantly associated with one cognitive measure in octogenarians, and BMI was not associated with any of the cognitive measures.

**Conclusions:** Although low levels of albumin were more prevalent in centenarians than octogenarians, albumin was a robust predictor of cognitive functioning for both age groups.

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**L.S. MILLER, M.B. MITCHELL, J.L. WOODARD, A. DAVEY, P. MARTIN, M. BURGESS & L.W. POON. Cognitive Capacity in the Oldest Old.**

**Objective:** The purpose of this study is to provide initial descriptions of cognitive capacity of a large population-based sample of centenarians. Normative data for several brief but global neurocognitive assessment tools amenable for frail elders are provided. Corresponding data from a smaller cohort of octogenarians is included for comparison.

**Participants and Methods:** Participants were 244 centenarians and 80 octogenarians from the Georgia Centenarian Study (GCS) who were administered a battery that included the Mini-Mental Status Examination (MMSE), the Behavioral Dyscontrol Scale (BDS), and the Severe Impairment Battery (SIB). Centenarians (age range 98–107) were divided into four age-based cohorts (98–99, 100–101, 102–103, 104–107). Octogenarians were divided into 5 year cohorts (80–84, 85–89). Descriptive statistics and normative ranges are provided for all tasks by age cohort.

**Results:** As would be expected, highly significant differences were found between groups on virtually all neurocognitive measures. Importantly, Centenarians showed greater variation and dispersion of scores in their neurocognitive performance, as well as a more significant relationship of age to performance. Normative results are presented in table form for each task and corresponding subtests by age cohort with means, standard deviations, range, min/max, percentage level, and cell N.

**Conclusions:** While most previous studies of centenarians have used a convenience sample, the GCS provides data on a population-based sample of centenarians, likely more applicable for comparison in applied settings. Our results suggest that centenarians look very different on cognitive testing than do even the oldest age range of most normative aging datasets (e.g. 85–90). Nevertheless, results support the use of global measures of neurocognition to describe cognitive status in this oldest old cohort, and we provide normative comparisons to do so.

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**M.B. MITCHELL, L.S. MILLER, J.L. WOODARD, M. BURGESS, P. MARTIN, A. DAVEY & L.W. POON. Functional Status in Centenarians and Octogenarians: Subjective versus Objective Measures.**

**Objective:** We compared the relationships between a performance-based measure and self and proxy reports of functional status in centenarians and octogenarians. We predicted the strongest relationships to be between proxy reports and observed performance of basic and instrumental activities of daily living (BADLs and IADLs). We additionally predicted that the discrepancy between self report and observed daily functioning in centenarians would be accounted for by decreased cognitive status.

**Participants and Methods:** Participants were 244 centenarians and 80 octogenarians from the Georgia Centenarian Study who were administered a battery that included the Direct Assessment of Functional Status (DAFS), self and proxy report of functional status, and the Mini-Mental State Examination (MMSE).

**Results:** In the centenarian group, the relationship between observed and proxy report was stronger than the relationship between observed and self report across BADL and IADL measures. Octogenarian proxy reports were significantly more related to observed performance of BADL but not IADL performance when compared to self reports. A significant amount of the variance in the discrepancy between self report and observed IADL performance in centenarians was accounted for by MMSE score. MMSE score did not explain a significant amount of the variance in the discrepancy between self report and observed BADL performance in centenarians.

**Conclusions:** Our results demonstrate the relationships between three methods of assessing functional status across two age groups of older adults and suggest that proxy report measures are generally more accurate than self report measures in centenarians. Results suggest that octogenarian proxy report is more accurate for BADL but not IADL measures.

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**C.A. MUNRO, J.M. WINICKI, D.J. SCHRETLEN, L. ZHANG, K.A. TURANO, B. MUNOZ, L. KEAY, E.W. GOWER, K. BANDEEN-ROCHE & S. WEST. Sex Differences in Cognitive Test Performance Persist into Old Age.**

**Objective:** Sex differences in cognitive test performance are consistently found. The advantages in verbal memory for women and visuospatial skills in men are usually attributed to sex hormones or sexual dimorphisms in brain structure. Because these factors change with age, it is unclear whether sex differences in cognition persist into late life. The aim of this study was to examine sex differences in patterns of cognitive test performance in healthy elderly individuals.

**Participants and Methods:** From a larger group of participants enrolled in the Salisbury Eye Evaluation Driving Study (SEEDS), data from 957 adults (477 men, 480 women), aged 67–88 years, were analyzed for this study. After matching men and women on age, education, self-rated depression, Mini-Mental State Examination score, and level of overall cognitive ability, we used multivariate analysis to test for sex differences in performance on specific cognitive measures.

**Results:** Men and women were indistinguishable on tests of auditory divided attention, fluency, and executive functioning. In contrast, women outperformed men on tests of psychomotor speed ( $p = .001$ ) and verbal learning and memory ( $p$  values ranged from  $.005$  to  $< .001$ ), whereas men outperformed women on tests of visual construction ( $p < .001$ ) and visual perception ( $p = .010$ ).

**Conclusions:** The pattern of sex differences in cognitive test performance observed in this study mimics that found in younger adults. Thus, age-related changes in factors thought to underlie sex differences in cognition do not alter sex differences established earlier in life.

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**C.M. NGUYEN, J. BARRASH, A. LALOGGIA, D. TRANEL, A. BECHARA & N.L. DENBURG. Personality Characteristics Associated with Poor Decision-Making in Normal Elderly.**

**Objective:** Some older adults show deficits in complex decision-making. The contribution of personality characteristics to that deficit in otherwise normal healthy adults was investigated. It was hypothesized that poor decision-making would be associated with personality ratings suggesting weakened executive functioning (e.g., lack of planning, indecisiveness).

**Participants and Methods:** Decision-making in healthy older adults ( $M_{age}=73.2\pm 7.2$  years) was assessed with the Iowa Gambling Task. Subsets of decision-makers - 11 Impaired and 14 Unimpaired were identified. Thirty personality characteristics were assessed with Iowa Scales of Personality Change (ISPC), on which family and friends made behaviorally-anchored ratings of participants' personality: "BEFORE" (over their middle-aged years) and "NOW" (current). "CHANGE" was calculated by subtracting "BEFORE" from "NOW" ratings. Ratings were dichotomized to reflect the presence/absence of personality difficulties now or before, and weakening of a personality characteristic (i.e., change in the adverse direction). Executive dysfunction scales included lack of planning, indecisiveness, lack of initiative, dependency, impulsivity and poor judgment.

**Results:** The Impaired and Unimpaired groups were compared on the proportion rated as having difficulties in multiple aspects of executive function. Chi-square tests showed little difference on ratings of current executive difficulties or change (weakening) from longstanding levels. Unexpectedly, longstanding executive difficulties were more likely among the Impaired (45.5%) than Unimpaired (0%),  $p<.005$ .

**Conclusions:** Results suggest poor decision-making in healthy, independent elderly may tend to be more a reflection of longstanding personality characteristics than of adverse age-related changes. The findings raise the possibility that ISPC ratings of longstanding personality characteristics may be able to predict particular functional deficits later in life.

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#### M. KRAFT & M.K. O'CONNOR. Aging and memory: The effects of a multi-component intervention.

**Objective:** Concern about memory loss is a common cause of stress and anxiety for many older adults. Behind this concern may lie a lack of knowledge and understanding about the normal changes in cognitive abilities that occur as one ages. The purpose of this study was to evaluate the impact of a 12-week cognitive education and rehabilitation group offered to non-demented older adults with subjective cognitive complaints. The group was designed to provide information about normal age-related cognitive changes and lifestyle factors that influence cognitive functioning, as well as teach compensatory techniques and cognitive rehabilitation skills.

**Participants and Methods:** The group was open to non-demented veterans (and spouses) over the age of 50 at two Veterans Affairs hospitals. The group, which met for 60 minutes once a week for 12 consecutive weeks, was run five times, resulting in a total of 40 participants. Questionnaires (Multifactorial Memory Questionnaire and Memory Functioning Questionnaire) were administered prior to the first group and at the end of the final group.

**Results:** A paired-samples t-test, comparing of pre- and post-group data, revealed that participants experienced an increase in their knowledge of normal age-related cognitive changes and a decrease in their level of concern about potential memory problems.

**Conclusion:** Groups such as this may be an effective way to provide older adults with accurate information regarding cognitive changes that occur as part of the normal aging process, and to alleviate stress and anxiety associated with such.

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#### K. O'MAHAR, A. RAJAH, J. PILAT, J. O'SHAUGHNESSY & B. LEAHY. RBANS Patterns of Performance as Predictors of Cognitive Decline.

**Objective:** Markers within the prodromal stages that predict decline in cognition may ultimately lead to better treatment of neurological conditions (Bondi, Jak, Delano-Wood, Jacobson, Delis, & Salmon, 2008;

Welsh-Bohmer, 2008), and serial assessment with neuropsychological screening instruments may be useful in identifying such markers. The current study examined whether patterns of performance on a commonly used screening tool among the elderly population (RBANS) predicted significant decline in cognitive functioning at 6 to 12 month follow up evaluation.

**Participants and Methods:** Participants included 71 patients (51% male; mean age = 78.8 years; mean education = 13.3 years) presenting at an out-patient memory disorders clinic with mild memory complaints. Data were collected at an initial screening and at a follow up appointment 6 to 12 months later. In this sample, 30% of patients demonstrated significant decline (defined as a decrease of 10% or greater in RBANS Total Score) in overall cognitive status within this time frame; 11% showed improvement.

**Results:** Time interval between appointments and change in RBANS Total Score were significantly correlated ( $r = -.35$ ,  $p = .003$ ), though even at briefer (6 to 8 month) follow up intervals, a substantial portion of patients (21%) demonstrated significant decline. Regression analyses indicated that relative weaknesses on Coding and List Recall subtests predicted decline in RBANS Total Score between time one and time two, above and beyond decline attributed to time between appointments.

**Conclusions:** Results indicate the RBANS may be helpful tool for predicting cognitive decline. Individual index score findings and implications for clinical practice are also discussed.

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#### K. POLLARD, K.J. MILLER, V. FERLA, J. KIM, L. ERCOLI, A. KAPLAN, D. DORSEY & G.W. SMALL. Predicting Cognitive Status in Older Adults Using Buschke, Age, and Cognitive Reserve.

**Objective:** Cognitive reserve might compensate for advancing brain pathology related to aging and possibly minimize cognitive decline. Prior research has suggested that higher education and pre-morbid IQ result in more cognitive reserve. The purpose of the current study is to examine whether the effects of cognitive reserve are present in all older adult age groups and to determine how accurately cognitive status can be predicted.

**Participants and Methods:** Participants (N=121) were first divided into three groups by age, including 71 "young", 42 "middle", 8 "oldest" older adults, then into three groups according to cognitive status, including: intact cognition (n=100), mild cognitive impairment (MCI; n=13), and dementia (n=8). The sample included: 44 males and 77 females, ages 50-89 with an average of 16 years of education.

**Results:** An ANOVA using cognitive status as the dependent variable and age and cognitive reserve (pre-morbid verbal IQ) as the independent variable revealed a significant main effect of cognitive reserve such that individuals with a superior IQ retained their intact cognitive status in all cases, while those with high average and average IQ's had slightly more cognitive decline, and those with low average or impaired IQ levels demonstrated the most cognitive decline. A further Discriminant Analysis revealed that age, cognitive reserve and the results of the Buschke selective reminding task can be used to correctly classify individuals' cognitive status (intact, MCI, or dementia) 88.4% of the time.

**Conclusions:** These results suggest that age and cognitive reserve based on education and IQ, as well as a selective reminding task, are important predictors of cognitive status in older adults. Future studies and implications are discussed.

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#### K. RAMCHANDRAN, J. ST. JOHN, N. MAHMOUD, A. BECHARA, D. TRANEL & N.L. DENBURG. Emotional Intelligence Predicts Older Adult Decision-Making Ability.

**Objective:** Health and financial decision-making dominates the life space of older adults. Recent findings in aging research attribute decision-making deficits in aging adults to generalized cognitive decline while others emphasize the decline in affective processing. The current study examined the role of cognitive (psychometric FSIQ) vs. emotional intelligence (EI) in age-related decision-making decline.

**Participants and Methods:** A sample of 23 healthy, community dwelling, individuals (M=71 years of age ; SD=9 years) were administered the Wechsler Abbreviated Scale of Intelligence (WASI), a measure of IQ; and the Mayer-Salovey-Caruso Emotional Intelligence Test V.2 (MSCEIT), an ability and performance-based measure of EI. In addition to an overall EI score, the MSCEIT yields two sub scores: experiential EI (online emotional processing based on emotion recognition and evoking of emotions) and strategic EI (ecological problem solving based on offline, accrued emotional knowledge). Decision-making was measured with the Iowa Gambling Task (IGT), a laboratory measure of real-world decision-making. Over the course of the IGT (5 blocks-20 trials/block), normal subjects typically learn to take advantageous decisions and reduce the disadvantageous choices they make.

**Results:** Linear growth modeling of the data indicate that higher EI scores predict a steeper rate of learning (advantageous decision-making) on the IGT ( $F=7.93$ ,  $p<0.01$ ), while FSIQ does not ( $F=0.07$ ,  $p>0.05$ ). Both experiential EI ( $F=5.31$ ,  $P<0.05$ ) and strategic EI ( $F=5.48$ ,  $p<0.05$ ) were significant predictors of rate of learning on the IGT.

**Conclusions:** This finding points to the significance of affective processing in complex decision-making in older adults. Lesion research has implicated the ventro-medial prefrontal cortex (VMPC) in decision-making and emotional intelligence. Thus, the findings of the current study can be taken to indicate disproportionate decline of the structures/functions of the VMPC with age.

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### S. RASKIN & H. GHALEB. Prospective Memory and Medication Adherence Performance Across Three Age Groups.

**Objective:** Prospective memory has emerged recently as an important cognitive domain with real implications for everyday functioning. While there has been considerable interest in prospective memory performance in older populations, there are no studies to date, that we know of, that address medication adherence as a factor in daily life.

**Participants and Methods:** In this study, we administered the Memory for Intentions Screening Test (MIST) and Patterson's Medication Management Adherence Scale (MMAS) to 25 health control subjects in each of three age groups (20-30 years of age; 40-50 years of age; and 60-70 years of age) for a total of 75 subjects.

The MIST allows for separate measurement of time-based and event-based cues, short versus long delays, and action versus verbal responses. Each of these was analyzed separately for the three age groups. In addition, overall performance on the MIST was compared to performance on the MMAS.

**Results:** Comparing Group 1 (ages 20-30) to Group 2 (ages 40-50) there were no group differences for time- versus event-based cues. However Group 2 performed significantly more poorly than Group 1 on the longer time delays (15 minutes) but not on the shorter time delays (2 minutes). Group 3 (ages 60-70) performance was significantly worse on time-based cues, longer delays, and verbal response items than the other two groups. MMAS performance correlated significantly with total MIST score and MIST error score.

**Conclusions:** These data suggest a drop-off in performance in prospective memory after age 50 and that this is related to activities of daily living such as medication adherence.

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### B. REED, J.J. MANLY, D. TOMMET, K. HAYDEN, A. AMANN, R. PIETRZAK, G. CHELUNE & R. JONES. Heterogeneous Trajectories of Cognitive Decline in Older Adults: Relationships to Neuropathology.

**Objective:** To distinguish trajectories of change in cognitive ability in older adults and explore their demographic and neuropathological determinants.

**Participants and Methods:** Data were from 1061 participants a longitudinal study of cognitive decline and dementia in older adults who

are cognitively normal at entry. Annual neuropsychological evaluations were summarized by a composite measure of global cognition (GCog) derived using Z scores of multiple donor tests. Both follow-up and autopsy rates were 95%; number of evaluations ranged from 1 to 15 with a mean of 5.5. Mean age at baseline was 75.7 and mean years education was 18.1. Data were analyzed using general growth mixture modeling. Longitudinal change was captured in two latent variables, one linear, the other quadratic.

**Results:** A 3 class solution best fit the data. The first class included 79% of cases and was characterized by a mean baseline GCog score about 0.2 SD above average, linear change near 0, and (by design) no quadratic change component. A second class (13%) had a below average baseline GCog mean (approximately -0.2 SD) and accelerating change over time reflected in significant linear and quadratic change components. A third class (8%) had very low baseline scores, and a large negative linear decline. Mortality differed substantially across groups: 25%, 51%, and 66% for Classes 1 – 3 respectively. Class 1 was 5 years younger on average. Education did not vary across class. In the 345 cases that came to autopsy, levels of both amyloid and tangle pathology differed in a graded way:  $1 < 2 < 3$  ( $p < .0001$ ).

**Conclusions:** Although replication is needed, results suggest that among well-educated, healthy elders, patterns of cognitive decline can be identified that are related to age at baseline, mortality rates, and neuropathology. These trajectories may prove to be both clinically useful and biologically meaningful.

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### E.E. RICHARDSON, J.L. WOODARD, M.A. JOHNSON, D. HAUSMAN, R.C. GREEN, L.S. MILLER, P. MARTIN, A. DAVEY & L.W. POON. C-Reactive Protein, Homocysteine and Cognitive Functioning in Centenarians.

**Objective:** An inflammatory pathophysiologic cascade may elevate the risk of cognitive decline in late-life. This study examined the relationship between cognitive performance and serum concentrations of C-reactive protein (CRP) and homocysteine in centenarians.

**Participants and Methods:** A population-based sample of 244 centenarians and near-centenarians between the ages of 98 and 108 (mean age 100.5 years) from the Georgia Centenarian Study served as participants. Participants were administered a global cognitive screening measure (Mini-Mental State Examination), measures of memory (Fuld Object Memory Evaluation; FOME) and executive functioning (Behavioral Dyscontrol Scale), an assessment of gross motor skills (hand tapping test) and a dementia severity rating scale (Global Deterioration Rating Scale) as part of a larger evaluation. Serum levels of homocysteine and CRP were quantified from a blood sample collected during an initial evaluation session.

**Results:** Elevated levels of CRP were significantly associated with poorer delayed recall performance on the FOME ( $t(198.33)=2.774$ ,  $p<.01$ ). Homocysteine levels were not significantly associated with performance in any of the cognitive domains assessed.

**Conclusions:** Centenarians with elevated levels of CRP demonstrated significantly lower performance on a delayed recall episodic memory task. Our findings suggest that the inflammatory process indicated by elevated CRP levels is not associated with global cognitive impairment in centenarians but may have a selective association with memory functioning, perhaps at the level of the hippocampus.

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### E.L. RISHER, S.A. ROGERS & D.A. LOWE. The Impact of Gender and Cognitive Impairment on Visuospatial Performance.

**Objective:** Many studies have analyzed gender differences in visuospatial performance; however, little research has explored the impact of cognitive impairment on these differences. This study examines the interaction of gender and cognitive impairment on visuospatial performance.

**Participants and Methods:** 89 older adults completed the Rey-Osterrieth Complex Figure and WAIS-III subtests of Block Design and Picture Completion. Participants were divided into four diagnostic groups: (a) normal aging, (b) age-associated memory impairment (AAMI), (c) mild cognitive impairment (MCI), and (d) dementia. Z-scores for the subtests were averaged to form a composite visuospatial z-score.

**Results:** Independent of diagnostic categories, there were no overall gender differences in the visuospatial measures,  $t(82-86) > 0.6$ ,  $p < 0.55$ . However, there was a significant interaction between gender and diagnosis on visuospatial measures,  $F(3,76) = 2.73$ ,  $p < 0.05$ . Men with AAMI performed significantly better than women on Picture Completion,  $t(14) = 2.19$ ,  $p < .05$ , and men with MCI had significantly better scores on Picture Completion, Block Design, and the composite visuospatial measure,  $t(25-26) > 2.38$ ,  $ps < .03$ . Men also performed significantly better than women on Picture Completion, Block Design, and the composite visuospatial measure when those with AAMI and MCI were grouped together,  $t(40-42) > 2.25$ ,  $ps < .04$ .

**Conclusions:** Gender differences in visuospatial performance emerge among those with either age-associated or mild cognitive impairment, with men outperforming women. Some impairment therefore seems to elicit gender differences; however, these differences seem to disappear in advanced stages of impairment, such as dementia. Perhaps men benefit from a cognitive reserve in visuospatial functioning, whereas women are more affected by visuospatial decline. These findings have implications for evaluating visuospatial performance among those with cognitive impairment and stress the importance of considering gender in norming procedures.

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#### Y. ROGALSKI, D. BIUN & J. REILLY. Effects of Contextual Information on Naming in Older Adults.

**Objective:** Older adults experience word-finding difficulties. However, the basis for this impairment is unclear. One common explanation is that older adults have lexical retrieval deficits. An alternative account is a general impairment in executive function. One way to facilitate naming is to provide more information by enriching a line drawing with surface detail. Another possibility is that additional detail will tax limited resources and impede naming. We investigated these possibilities using a common neuropsychological measure of naming impairment.

**Participants and Methods:** We analyzed speeded naming latencies of healthy older adults ( $N=8$ ) for the 60-item Boston Naming Test. Participants named these pictures under four conditions: 1) black/white (baseline), 2) color/texture (brown dog with fur), 3) congruent background context (green fish in blue aquarium), 4) incongruent context (fish in bedroom). Stimuli were randomized within blocks. Stimulus delivery was standardized using E-Prime software.

**Results:** Reaction times by item analysis were similar for the black/white ( $m=1124$  ms) and color/texture ( $m=1124$  ms) conditions ( $p>.05$ ) and also for the congruent ( $m=1248$  ms) and incongruent ( $m=1242$  ms) context conditions ( $p>.05$ ). The presence of background context (fish in aquarium) slowed response times ( $m=1145$  ms) compared to no background context (fish alone) ( $m=1063$  ms). This effect was independent of whether the context was congruent or incongruent with the target ( $p=.02$ ).

**Conclusions:** We found that additional detail in pictures impeded naming. This is consistent with a domain general impairment in executive function. These results offer a potential explanation for understanding the basis of word-finding difficulties in older adults.

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#### S.A. ROGERS, R. GRANT & D.A. LOWE. Organizational Strategy and Cognitive Impairment Among Older Adults.

**Objective:** Some research suggests that the Rey-Osterrieth complex design can be used to assess organization strategies in addition to visu-

ospatial abilities. However, little has been done to examine these strategies among older adults or the relationship between these strategies and the level of cognitive impairment. This study examines the relationship between organizational skills and cognitive impairment among older adults.

**Participants and Methods:** 112 older adults (ages 56-104) completed a comprehensive neuropsychological battery, including the Rey-Osterrieth Complex Figure. Participants' organizational strategies were coded in to three groups: (a) organized, (b) disorganized, (c) and perceptually distorted. Participants were also divided into three diagnostic groups: (a) normal aging, (b) mild cognitive impairment (MCI), and (c) dementia.

**Results:** Those using an organized approach were significantly younger than those with either a disorganized or perceptually distorted approach,  $F(2,97) = 3.76$ ,  $p < .03$ . Chi-square procedures also revealed significant differences in approach between diagnostic groups,  $\chi^2(4, N = 100) = 25.27$ ,  $p < .0001$ . Those with normal aging were more likely to use an organized approach, whereas those with mild cognitive impairment or dementia were more likely to use a disorganized or perceptually distorted approach, with the greatest perceptual distortion among those with dementia.

**Conclusions:** These findings suggest that organizational strategy can be used to differentiate between age-related diagnostic groups and that a decrease in organizational ability may be a preclinical sign of underlying cognitive decline.

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#### S.K. SHIVAPOUR, C.A. COLE, M. HERNANDEZ, A.R. KAUP, D. TRANEL, A. BECHARA & N.L. DENBURG. Age-Related Changes in Financial Decision Making.

**Objective:** The ability to make sound financial decisions across the lifespan is critical for interpersonal, occupational, and psychological health and success. Although Healey and Hasher (Forthcoming) argue that many processes that decline with age may be unimportant or even confer certain advantages, other researchers note that impairments in abilities such as working and declarative memory may prevent older adults from making satisfactory choices (Yoon, Cole, & Lee, Forthcoming). The present study compared older adults' ability to make a series of financial decisions with that of a college sample.

**Participants and Methods:** Sixty-five older adults, aged 60 and above, and 102 college students completed the Financial Decision Making Questionnaire, which requires selecting from options in four scenarios and answering financial knowledge questions.

**Results:** Older adults were more likely to decide immediately how to allocate their money ( $p=.007$ ). Older adults were also more concerned with avoiding losing money ( $p=.07$ ), whereas younger adults were more interested in gaining money ( $p=.003$ ). Additionally, college students allocated more money to savings than older adults ( $p<.001$ ), but were more likely to buy a TV despite having credit card debt ( $p=.02$ ). Finally, older adults showed greater financial knowledge than the college sample.

**Conclusions:** The findings suggest a risk aversion tendency among older adults, and support findings that semantic knowledge remains largely intact with age. The tendency among older adults to make immediate financial decisions parallels findings that ill older adults seek medical care sooner, perhaps to conserve diminishing cognitive resources characteristic of differential aging of the prefrontal cortex.

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#### R. HOLTZER & M.J. SHUMAN. Learning and Cognitive Fatigue Effects on Attention Networks in Aging.

**Objective:** We used the Attention Network Test (ANT) to examine the effect of cognitive fatigue and learning on alerting, orienting and executive attention in aging.

**Participants and Methods:** Methods: Participants were non-demented individuals age 70 years and older (N=232) enrolled in the Einstein Aging Study. Conceptually, cognitive fatigue was defined as a failure to sustain attention during task performance. Operationally, we defined cognitive fatigue as a decrement in performance over the course of the ANT (blocks 1 through 3). Learning was defined as improvement in performance over time.

Statistical analyses: Separate repeated-measures ANOVAs used block as the three-level within subject variable. Performance on the three attention networks (measured in millisecond reaction time) served as dependent variables.

**Results:** Results: There was a significant cognitive fatigue effect for executive attention,  $F(2, 462) = 4.74, p = 0.009$ . Contrast analysis revealed that mean reaction time in block three, was significantly higher than in block one [ $F(1, 231) = 9.66, p = 0.002$ ] indicating that performance became worse over the course of the ANT. In contrast, there was a significant learning effect for alerting,  $F(2, 462) = 3.36, p = 0.036$ . Contrast analysis revealed that performance due to alerting cues was improved significantly in block three compared to block one,  $F(1, 231) = 7.07, p = 0.008$ . Orienting was not sensitive to either learning or cognitive fatigue.

**Conclusions:** This study demonstrated that the alerting and executive attention networks were sensitive to learning to cognitive fatigue in aging, respectively.

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**E. VAKIL, T. RAZ & D.A. LEVY. Probing the brain substrates of cognitive processes responsible for context effects on recognition memory.**

**Objective:** Context effects on episodic recognition memory involve separable contributions of target-context binding, additive familiarity, and configural constancy. Here we examine whether these factors reflect contributions of processes attributed to different brain substrates.

**Participants and Methods:** First, we challenged frontal and medial temporal lobe-based cognitive capacities in healthy young adults, employing divided attention tasks at encoding and retrieval, and extended retrieval delay, respectively. In a second experiment, older adults were identified by neuropsychological testing as having different levels of frontal and medial temporal lobe-dependent cognitive functions.

**Results:** Target-context binding effects were specifically attenuated by delay, but not by divided attention. Consistent with Experiment 1, older adults with low medial temporal lobe function exhibited reduced target-context binding effects, but in those with low levels of frontal function binding effects were intact.

**Conclusions:** These findings indicate that unlike source memory, context effects on memory are associated with the integrity of medial temporal lobe-based processes but not with the integrity of frontal lobe-based processes.

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**A. VALLESI, D.T. STUSS, A.R. MCINTOSH & T.W. PICTON. Electrophysiological Evidence of Age-related Differences in Processing Task-Irrelevant Material.**

**Objective:** Aging impairs the capacity to ignore irrelevant information. It is still debated whether these problems arise from both conflict and non-conflict irrelevant material. This study addresses this issue.

**Participants and Methods:** A group of young (N=14; 20-34 years) and a group of elderly (N=14; 60-80 years) healthy participants were tested on a go/nogo paradigm. The task was to respond to red X and blue O (target go: 50% of the trials) while withholding responses to two categories of nogo stimuli. A first category of nogo stimuli,

that is blue X and red O, was supposed to create conflict because it shared a pertinent feature (letter identity) with the go stimuli (conflict nogo: 25% of the trials). A second category of nogo stimuli were numbers of either color (non-conflict nogo: 25% of the trials). Accuracy, response times (RTs) and event-related potentials (ERPs) were collected.

**Results:** Both young and elderly groups made more commission errors to conflict than to non-conflict nogo stimuli (5 vs. 1%, with non significant age differences), indicating difficulty in withholding a response to conflict nogo. Besides later RTs to go stimuli and later P3 waves for the conflicting stimuli than the young group, elderly participants showed pronounced left posterior P2 and pre-central P3 components to the non-conflict nogo stimuli.

**Conclusions:** These findings suggest that elderly individuals have difficulty in ignoring irrelevant stimuli, even when they are easily distinguishable from the relevant stimuli, and have to actively suppress a response to them.

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**D.E. VANCE & K.K. BALL. Does Memory, Reasoning, and Speed of Processing Affect Falling among Community-Dwelling Older Adults?**

**Objective:** Older adults are at higher risk of falling and of suffering greater devastating effects from such falls. The objective of this study was to longitudinally examine predictors for risk of falling such as cognitive composites (reasoning, memory, speed of processing) along with traditional predictors.

**Participants and Methods:** Data on falls, cognition, objective functional tests, visual acuity, and demographic data were collected on older adults at baseline (N = 698) and at a two-year annual follow-up (n = 550).

**Results:** By using hierarchical multiple regression, we found that older age, being an older Caucasian woman, poorer performance on Turn 360 at baseline, and having a better memory at baseline predicted higher reports of falling in the past two months at the two-year follow-up.

**Conclusions:** These results confirm prior findings except for memory; however, better memory as a predictor of falls may indicate that there is a recall bias dependent on memory function.

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**S. VANDERHILL, D.F. HULTSCH, M.A. HUNTER & E. STRAUSS. Self-Reported Cognitive Inconsistency in Older Adults is Related to Memory Decline.**

**Objective:** Insight into one's own cognitive abilities, or metacognition, has been widely studied in developmental psychology. Relevance to the clinical neuropsychologist is high, as memory complaints in older adults show an association with impending dementia, even after controlling for likely confounds. Another candidate marker of impending dementia under study is inconsistency in cognitive performance over short time intervals. Although there has been a recent proliferation of studies of cognitive inconsistency in older adults, to date, no one has examined adults' self-perceptions of cognitive inconsistency.

**Participants and Methods:** Participants were 94 community-dwelling older adults (aged 70-91) taking part in a longitudinal study of cognitive change in aging. A novel 40-item self-report measure of everyday cognitive inconsistency, the Cognitive Variability Questionnaire (CVQ) was administered, which included parallel scales indexing inconsistency five years ago and at present. External validity of the CVQ was explored through correlations with functional, health, affective, metacognitive, and neuropsychological measures.

**Results:** The sample reported an increase in inconsistency over time. Higher reported present inconsistency and greater five-year increase in inconsistency were associated with noncognitive (i.e., older age, poorer

ADLs, poorer health, higher depression), metacognitive (i.e., poorer self-rated memory) and neuropsychological (i.e., poorer performance and greater five-year decline in global cognitive status, vocabulary, and memory) measures. Correlations between self-reported inconsistency and memory decline largely persisted when self-rated memory was controlled.

**Conclusions:** Observed relationships between self-reported inconsistency and measures of neuropsychological (including memory) status and decline suggest that self-perceived inconsistency may be an area of relevance in evaluating older adults for memory disorders.

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#### J.G. WESTHAFFER, M.W. HAUT, M.T. MORAN & L.A. MORROW. Aging, Cognitive Reserve and Cognitive Performance.

**Objective:** A hypothesis driven approach was taken to assess the relationship between cognitive reserve (CR) and age-related changes in cognitive functioning. Specifically, processing speed as well as frontal and temporal lobe functioning were examined in a healthy sample. It was hypothesized that CR would moderate the effects of age on all measured areas of cognitive functioning.

**Participants and Methods:** We studied 30 medically and psychiatrically healthy males aged 40-65. A CR variable was created based on factor analysis of years of education, NART reading, and WAIS-III Vocabulary and Similarities scores. An interaction variable was then created by multiplying CR and age. Performance on cognitive tasks was used to represent cognitive processing speed and frontal and temporal lobe functioning.

**Results:** Pearson correlations were calculated between age, CR, age x CR, and cognitive performance. Increasing age was significantly ( $p < 0.05$ ) correlated with slower cognitive processing and poorer response inhibition and cognitive flexibility. Higher CR was significantly correlated with better working memory, verbal fluency, and verbal memory. Age x CR was significantly correlated with better working memory, verbal fluency, verbal memory, and quicker cognitive processing speed. The absolute value of these correlations ranged from .335 to .559.

**Conclusions:** In aging, higher CR was associated with better memory (temporal) and executive (frontal) functions. More interestingly, CR moderated the effects of age on processing speed and executive functions. Specifically, performance on Digit Symbol and Trails had a negative correlation with age, but a positive correlation with Age x CR. Thus, CR can overcome some of the cognitive effects associated with age.

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#### B.R. WILLIAMS, C.D. MARTIN & P.J. DONOVICK. Are Older Adults More Susceptible to Retroactive Interference on the CVLT-II Than Young Adults?

**Objective:** It is suggested that a nonverbal task be administered during the delay interval of the California Verbal Learning Test-II (CVLT-II) to minimize the effects of retroactive interference (RI) on recall of words after the delay. We evaluated the effects of RI on recall of words during Long-Delay recall of the CVLT-II.

**Participants and Methods:** Participants were 120 undergraduate students and 100 adults age 60 and older. All participants completed the CVLT-II Immediate and Short-Delay Recall trials. During a 25-minute delay interval participants received either a verbal (WAIS-III Vocabulary or Peabody Picture Vocabulary Test-III) or nonverbal (Raven's Standard Progressive Matrices or WAIS-III Block Design) intervening task. At the end of the delay period, the CVLT-II Long-Delay Recall trials were administered. We hypothesized that individuals given a verbal task during the delay would produce more intrusions and recall fewer words during the Long-Delay Recall trials than individuals administered a nonverbal task. Additionally, we predicted that older adults would produce more intrusions and recall fewer words than young adults.

**Results:** Regardless of the type of intervening task received, young adults and older adults recalled the same number of words and produced a similar number of intrusions as their peers during the Short and Long-Delay Recall trials. We also found that older adults made more intrusions and recalled fewer words than young adults.

**Conclusions:** The results of this study suggest that, regardless of age, verbal tests may produce a minimal amount of interference on recall on the CVLT-II. Furthermore, the results suggest that processes other than RI also cause decline in recall in the aging.

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#### S. YEUNG, T. PATERSON, J.L. KUBIK & W.L. THORNTON. Systolic Blood Pressure as a Predictor of Everyday Problem Solving in Older Women.

**Objective:** Hypertension is often associated with age-related cognitive decline, although the underlying mechanisms remain elusive. Nonetheless, few studies have explored the effects of blood pressure (BP) on everyday problem solving (EPS), which may predict real-world functioning better than traditional measures. We previously reported that hypertensive individuals performed worse than normotensives on EPS measures. In the current study, we examined BP as a continuous variable, allowing for a more comprehensive analysis of prehypertensive/borderline hypertensive effects on EPS.

**Participants and Methods:** Non-demented community-dwelling women ( $n = 61$ ; age: 51-91) were recruited from senior centres throughout metro Vancouver. Averages of three systolic (SBP) and diastolic (DBP) readings taken during assessment were used as predictors. EPS performance was determined by the number of safe/effective solutions (inter-rater reliability: 0.85) generated for 16 common everyday problems taken from extant literature.

**Results:** Findings from regression analyses suggested that higher SBP (range: 96-182mmHg) predicted better EPS performance after accounting for age, education, and anti-hypertensive medication use ( $\beta = .246$ ,  $p < .030$ ). Modelled variables explained 35.2% of the variance in EPS performance ( $p < .001$ ). No significant relationship between DBP and EPS was found after controlling for demographic variables.

**Conclusions:** Results suggest that mild SBP elevations predict better EPS performance in older women beyond anti-hypertensive medication use. Complex relationships between BP, age, and EPS may exist in normotensive and prehypertensive women that are not necessarily reflective of changes observed in hypertensive individuals. Findings align with previous models suggesting that mild BP elevations may be positively associated with cognitive performance in later life.

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#### M.E. ZIMMERMAN, W. RAMRATAN & R.B. LIPTON. Sleep and Neuropsychological Functions in Nondemented Older Adults.

**Objective:** It is well-established that older adults with dementia exhibit disturbances in both cognitive function and sleep/wake cycles. Less is known, however, about the relationship between these factors in healthy older men and women. The goal of this study was to examine associations between sleep and neuropsychological functions in a community-based sample of nondemented older adults.

**Participants and Methods:** 479 participants (mean age 80 years) underwent neuropsychological assessment and completed the MOS Sleep Scale, a standardized survey of sleep behaviors over a 4-week period. Principal components analysis was used to obtain three neuropsychological factors: verbal IQ, executive/attention, and verbal memory. A summary sleep problems index was derived from the sleep survey. Linear regression was used to examine sleep as a predictor of neuropsychological function.



**Results:** Older adults reported an average of 6.5 hours of sleep per night. Average levels of self-reported sleep difficulties were consistent with published normative data. Sleep disturbance was associated with verbal IQ abilities ( $\beta=-0.14$ ,  $p<0.01$ ; overall model  $R^2=0.07$ ,  $p<0.01$ ) after controlling for age and gender, but not with executive/attention or verbal memory abilities. When education was considered, sleep disturbance was associated with verbal IQ in older adults with more than 12 years of education ( $\beta=-0.14$ ,  $p<0.02$ ; overall model  $R^2=0.10$ ,  $p<0.01$ ), but not in those with 12 years of education or less.

**Conclusions:** Among older adults with higher education, sleep disturbance is associated with verbal IQ abilities after controlling for the effects of age and gender. Additional analyses should explore the educational specificity of this relationship as a potential reflection of a loss of social or biological zeitgebers in older adults with lower education. Future studies should also assess longitudinal relationships between changes in both sleep and cognitive function.

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## Cognitive Neuroscience

**O. BOXER, I. MOLNAR-SZAKACS, D.A. KAUFMAN, G. STAVRO, X.E. CAGIGAS, C. PALIVOS, C. JACOBSEN, D. STROUP, E. WU & R.M. BILDER. Schizotypy and Lifetime Creative Achievement in a Large Healthy Adult Sample.**

**Objective:** Creativity - the ability to produce work that is novel, unique and useful - relies on two modes of thinking: convergent and divergent. While convergent thinking is the narrowing of all possible solutions to the "best" one, divergent thinking is the generative elaboration of an idea to arrive at multiple possible solutions. It requires an expansion of thought that reaches beyond typical boundaries to generate novel combinations or associations. This ability to generate atypical ideas or concepts through the process of divergent thinking has also been linked to schizotypal personality traits. Given the notable link of divergent thinking to both creative achievement and schizotypy, we studied high and low creative achievers on tests of divergent thinking and schizotypal traits.

**Participants and Methods:** A sample of 191 healthy adults participated in a battery of tests including the Torrance Tests of Creative Thinking (TTCT), Creative Achievement Questionnaire (CAQ), and the Chapman Scale for Psychosis-Proneness.

**Results:** T-test comparisons between participants scoring high (1SD above the mean CAQ score) and low (1SD below the mean CAQ score) on lifetime creative achievement revealed significant differences on divergent thinking tasks from the TTCT, including verbal and nonverbal subtests, as well as on schizotypy as revealed by the Chapman Scales.

**Conclusions:** High creative achievers attained significantly higher scores on divergent thinking tasks and the schizotypy measure, as compared to low creative achievers. These results suggest that individuals who are highly creative are able to successfully harness an 'out-of-the-box' divergent thinking style which shares some features with schizotypal personality.

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**G. STAVRO, D.A. KAUFMAN, O. BOXER, I. MOLNAR-SZAKACS, X. CAGIGAS, D. PALIVOS, C. JACOBSEN, D. STROUP, E. WU & R.M. BILDER. Cognitive and Personality Predictors of Creative Achievement.**

**Objective:** Creativity involves generating, manipulating, and extending ideas to produce information that is novel and useful. Research has demonstrated that both cognitive and personality factors are associated

with creative potential and achievement. This study sought to understand the relative predictive value of traditional cognitive abilities (i.e., intelligence (IQ), executive functioning (EF)), cognitive flexibility (i.e., divergent and convergent thinking), and personality traits for attaining success in creative domains.

**Participants and Methods:** 191 healthy adults completed subtests from the Wechsler Abbreviated Scale of Intelligence (WASI), Delis-Kaplan Executive Function System (D-KEFS: Verbal Fluency), a measure of verbal working memory, Torrance Tests of Creative Thinking (TTCT), Remote Associates Test (RAT), NEO Personality Inventory (NEO-PI), Chapman Scale for Psychosis Proneness, and Creative Achievement Questionnaire (CAQ).

**Results:** Bivariate correlations demonstrated that lifetime creative achievement was significantly associated with higher IQ, verbal fluency, cognitive flexibility (i.e., stronger divergent and convergent thinking abilities), personality factors of openness and agreeableness, and schizotypal personality traits. However, when including these variables in multiple regression analyses, the only significant predictors of creative achievement were divergent thinking ability and the personality factors of openness to experience and reduced agreeableness.

**Conclusions:** These results suggest that IQ and EF are related to creative achievement. However, their ultimate influence appears to be accounted for by potential intermediate factors such as the ability to think in unique ways and extend one's ideas, as well as personality factors related to one's motivation and willingness to apply these novel means of processing information.

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## Cross Cultural

**X.E. CAGIGAS, J.V. FILOTEO, W.T. MADDOX & M. COLE. Cultural determinants of explicit and implicit category learning.**

**Objective:** Previous studies have demonstrated ethnic group differences on various cognitive tasks, such as measures of attention. Few studies, however, have looked at ethnic differences in various aspects of learning and memory. In the current study, we investigated whether there were any cultural differences in implicit or explicit category learning using a task with well-established neural correlates.

**Participants and Methods:** Participants included 72 Caucasian, 50 Chinese, and 47 Latino college students who ranged from foreign-born bilingual immigrants to monolingual American nationals. Participants learned to sort stimuli into two predetermined categories by receiving corrective feedback under two different learning conditions: an explicit condition where learning is thought to be mediated primarily by the frontal cortex and anterior caudate, or an implicit condition where learning is thought to be mediated primarily by the posterior caudate.

**Results:** ANOVA analyses examining accuracy rates demonstrated that Caucasians learned better than both Chinese and Latino participants in the explicit condition, whereas there were no group differences in the implicit condition. Regression analyses indicated that mainstream acculturation, but not ethnicity per se, was a significant predictor of learning in the explicit condition, but these variables were not associated with performance in the implicit condition.

**Conclusions:** These results suggest that (1) mainstream acculturation can influence performance on an explicit category learning task, and (2) implicit category learning processes are not sensitive to ethnic or acculturation differences observed in previous studies. Overall, these findings suggest that cultural influences might manifest in different brain systems, with frontal-based systems being more affected by cultural variables than subcortical-based systems.

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**C.M. FUNES, N. MAHMOUD, S. BAYAN & J. RAZANI. The Color Trails Test: More Culture-Fair than the Trail Making Test?**

**Objective:** The Trail Making Test (TMT) is an effective measure of visual attention and executive functioning. However, its reliance on the English alphabet limits its use cross-culturally. In response to this constraint, the Color Trails Test (CTT) was designed to serve as an equivalent measure to the TMT, and facilitate use with varying cultures. The purpose of this study was to compare the performance of an ethnically diverse group on the CTT and the TMT to a group of monolingual, English-speaking Caucasians.

**Participants and Methods:** 233 healthy participants, recruited from the Los Angeles area participated in this study; 85 were monolingual English-speaking Caucasians, and 148 participants encompassed an ethnically diverse group of Asian, Latino, or Middle-Eastern descent. All participants were administered both the TMT and the CTT in its entirety. The CTT utilizes a color-number sequencing task (CTT-2) to substitute for the letter-number sequencing task of the TMT (part B).

**Results:** One-way ANOVAs comparing performance of Caucasian and the diverse groups on both the TMT and the CTT were performed. As expected, the diverse group performed significantly poorer than the Caucasian group on the TMT parts A & B ( $p$  values < .05). Additionally, the diverse group performed significantly poorer than the Caucasian group on the CTT-2 task ( $p$  < .05) but no differences were found between groups on CTT-1.

**Conclusions:** These findings indicate that the assertions about the cultural-fairness of the CTT may perhaps be unwarranted, and both clinicians and researchers should use caution when assessing ethnically diverse peoples with this instrument.

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**S. GUPTA, S.P. WOODS, L. CYSIQUE, I. GRANT & R.K. HEATON. Investigation of Failed Hiscock Digit Memory Test Performance in Adults in Rural China.**

**Objective:** The Hiscock Digit Memory Test (HDMT) was designed to detect poor effort on Neuropsychological (NP) testing. Non-compensation seeking demented subjects in the U.S. obtain  $\geq 90\%$  accuracy scores. Effort is considered suspect if HDMT scores are  $\leq 90\%$ . However, it unknown whether similar HDMT accuracy should be expected in non-US populations with very different cultural/educational backgrounds.

**Participants and Methods:** Longitudinal (12 month) NP data were collected from 294 rural Chinese adults participating in a study of HIV and HCV infections. 4 cases were identified with suspect effort (SE) at T1, T2, or both. All were infected women with low levels (3-6 years) of education. Their NP results were compared with those of 58 HIV+ women with comparable education, who scored  $\geq 90\%$  on HDMT. We hypothesized that truly poor effort would result in increased variability in NP test performance across time, without consistent practice effects.

**Results:** Each SE participant's variability in NP change scores from T1-T2 was comparable to that of the comparison group, indicating relatively stable performance over time. Their NP scores at T2 showed consistent practice effect, even though their HDMT scores were quite variable (suspect to normal; normal to suspect; suspect to suspect). Additionally, each of the SE participants displayed lower mean NP scaled scores at both T1 and T2, relative to the comparison group.

**Conclusions:** Results do not suggest that SE participants exerted sub-optimal effort, since they did not demonstrate aberrant variability in performance across two NP battery administrations, and they evidenced a consistent practice effect. Instead, their performances on HDMT may signal genuine NP impairment in these women, as their NP battery performance was lower than the comparison group at both time points.

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**C.D. MARQUEZ DE LA PLATA, J. ARANGO-LASPRILLA, M. ALEGRET, A. MORENO, L. TARRAGA, M. LARA, M. HEWLITT, L. HYNAN & C. CULLUM. A Cross-Cultural Investigation of Three Spanish Naming Tests.**

**Objective:** The use of translated naming tests for evaluating predominantly Spanish-speakers has recently been challenged on the grounds that translating test items may compromise a test's construct validity. The Texas Spanish Naming Test (TNT) was developed in Spanish specifically for use with Spanish-speakers; however, it is not yet known whether its design results in an improved test for this diverse population. The present study evaluated and compared the internal consistency and patterns of item-difficulty and -discrimination for the TNT and two commonly used translated naming tests in 3 countries to test the hypothesis that a naming test developed in Spanish has superior psychometric properties than a translated naming test.

**Participants and Methods:** Two hundred fifty two subjects (136 demented, 116 nondemented) across three countries (i.e., United States, Colombia, Spain) were administered the TNT, Modified Boston Naming Test-Spanish, and the CERAD naming subtest. Cronbach's alpha was used to determine the internal consistency of the TNT for each sample. A MANCOVA was used to determine naming test differences while controlling covariates. Item difficulty and discrimination indices were determined for each item of each test across the three countries. Pearson correlations were used to determine the association between order of item administration and both item difficulty and discrimination, respectively.

**Results:** Internal consistency of the TNT was superior to its counterparts across countries. The TNT demonstrated a superior pattern of item difficulty than the CERAD naming test, and the most desirable distribution of item discrimination indices across countries sampled.

**Conclusions:** While all three Spanish naming tests differentiated nondemented and moderately demented individuals, the results suggest the items of the TNT are most appropriate to use with Spanish-speakers. Preliminary normative reference data for the three tests examined in each country are provided to help guide clinical interpretation.

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**P. SAEZ, H.A. BENDER, W.B. BARR, C.M. MORRISON, B. VAZQUEZ & M. RIVERA-MINDT. The Relationship Between Acculturation and Nonverbal Neuropsychological Test Performance Among Hispanic Epilepsy Patients.**

**Objective:** It is often assumed that nonverbal- and performance-based measures minimize the impact of cultural factors on neuropsychological (NP) test performance. However, few studies have examined the impact of acculturation on nonverbal test performance in Hispanics, less still within clinical populations. The present study examined the relationship between acculturation and nonverbal neuropsychological test performance in adult Hispanic epilepsy patients.

**Participants and Methods:** Forty-eight Spanish-speaking Hispanic participants with confirmed epilepsy were administered a neuropsychological battery, including the Rey Complex Figure Test (RCFT), Ravens Standard Progressive Matrices (RSPM), Ruff Figural Fluency Test (RFFT), Grooved Pegboard (GP), Brief Visual Memory Test (BVMT), and Bidimensional Acculturation Scale (BAS), a Spanish-language measure of both English and Hispanic acculturation. Participants ranged in age from 18-63 years ( $M = 33.33$ ,  $SD = 10.19$ ), averaged 12.75 years of education ( $SD = 3.46$ ), self-identified as Hispanic, and originated from Spanish-speaking countries. The English domain of the BAS was used to determine participants' degree of acculturation to English-speaking culture.

**Results:** Findings revealed that level of acculturation is positively correlated with performance on the RSPM (Spearman  $r = .411$ ,  $p = .006$ ), BVMT total recall (Spearman  $r = .344$ ,  $p = .018$ ), RCFT Copy (Spearman  $r = .386$ ,  $p = .007$ ) and delayed recall (Spearman  $r = .338$ ,  $p = .022$ ). Degree of acculturation was inversely correlated with visuomotor dexterity bilaterally (Spearman  $r = -.361$  -  $.318$ ,  $p \leq .05$ ).

**Conclusions:** Results demonstrate that the impact of acculturation is not attenuated by neurological illness and suggests that acculturation should be considered when administering nonverbal tests.

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**T. SANDOVAL, T.H. GOLLAN, R.I. MONTOYA, M. CHAMPION, C. CERA & D.P. SALMON. Aging Effects on Cross-Language Intrusions: Why Octopus Slips into Animales.**

**Objective:** Models of bilingual language processing assume that bilinguals cannot “shut one language off,” and rely on inhibitory control to maintain target-language production. If so, age-related decline in inhibitory control may increase the rate of cross-language intrusions during verbal fluency tasks particularly in the non-dominant language.

**Participants and Methods:** We compared older ( $n=16$ ; 81% English-dominant;  $M$  age = 79.19;  $SD=6.59$ ) and younger ( $n=39$ ; 71% English-dominant;  $M$  age = 19.84;  $SD=1.41$ ) Spanish-English bilinguals for cross-language errors in 4 letter and 5 semantic fluency categories in English and Spanish.

**Results:** Older bilinguals made significantly more Spanish intrusions into English ( $M=0.5\%$ ;  $SD=0.9\%$ ;  $F(1, 53)=11.38$ ,  $\eta^2=.18$ ,  $p<.01$ ) and English intrusions into Spanish ( $M=1\%$ ;  $SD=1\%$ ;  $F(1, 53)=9.41$ ,  $\eta^2=.15$ ,  $p<.01$ ) than younger bilinguals ( $M=0.02$ ;  $SD=0.1$  and  $M=0.4$ ;  $SD=0.9\%$ , respectively), independent of education, English acquisition age, or total fluency scores. English-to-Spanish intrusions were more common than Spanish-to-English intrusions, significantly for English-dominants ( $p<.01$ ) and trending in the same direction for Spanish-dominant bilinguals.

**Conclusions:** Age-related decline in language control increases difficulty in preventing activation and production of the non-target language. This language control hypothesis does not explain why English-to-Spanish intrusions are more frequent than the reverse in bilinguals regardless of language dominance. There may be an external locus for bilingual control from the dominant environment.

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**J. PENA, N. OJEDA, G.D. PEARLSON & D.J. SCHRETLEN. Do Performance Differences on the Trail Making Test and Brief Test of Attention in Spain vs. the USA Reflect Culture or Neurology?**

**Objective:** We compared the performance of healthy adults in Spain and the USA on English and Spanish versions of the Trail Making Test (TMT) and Brief Test of Attention (BTA).

**Participants and Methods:** Healthy adults were recruited from the USA ( $n=203$ ) and Spain ( $n=213$ ). The groups did not differ in age (USA =  $44\pm 14$  vs. Spain =  $43\pm 15$ ;  $p=0.8$ ), gender (USA = 42% vs. Spain = 49% males;  $p=0.2$ ) or years of education (USA =  $14\pm 3$  vs. Spain =  $13\pm 4$ ;  $p=0.2$ ).

**Results:** The US and Spanish groups did not differ in performance on the BTA ( $16.4\pm 3.3$  vs.  $16.7\pm 2.8$ ;  $p=0.43$ ). Americans were faster than Spaniards on Parts A ( $29\pm 11$  vs.  $41\pm 28$  seconds;  $p<0.001$ ) and B ( $74\pm 48$  vs.  $88\pm 61$  seconds;  $p<0.01$ ) of the TMT. However, the U.S. group made more errors on Trails A ( $0.18\pm 0.4$  vs.  $0.08\pm 0.2$ ;  $p<0.01$ ) and showed a greater decrement in performance on Trails B relative to A ( $B/A=2.6\pm 1.1$  vs.  $2.2\pm 0.7$ ;  $p<0.001$ ). These differences were restricted to participants aged 40 and older. Younger U.S. and Spanish participants did not differ on any cognitive measure.

**Conclusions:** Healthy American and Spanish adults showed nearly identical performance on the BTA. Americans were faster but made more errors and showed a greater decrement on Trails B/A than Spaniards. These differences were restricted to older adults and can be conceptualized as reflecting cultural-stylistic rather than neurological factors. The BTA might be useful for international clinical trials.

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**M. SHANAHAN, E.G. WILLCUTT & B.F. PENNINGTON. Comparing Neuropsychological Profiles of ADHD Across Ethnicities: Implications for Validity.**

**Objective:** Neuropsychological profiles of ADHD have been extensively researched in samples composed mostly of Caucasian children, resulting in several well-replicated results (e.g., deficits in behavioral inhibition, vigilance, verbal working memory, and processing speed). However, no published studies have investigated the neuropsychological profile of ADHD in other ethnic groups. In this study, we compared the neuropsychological profiles of African American (AA) children to Caucasian-American (CA) children, with and without ADHD, to determine whether the deficits are equally severe and the same set of domains are affected. This study has implications for broader questions regarding the validity of ADHD in a wide range of ethnic groups.

**Participants and Methods:** All 442 participants completed subtests from WISC-III, Stop Task, Gordon Diagnostic System, and the Sentence and Counting Span tasks.

**Results:** Results found significant main effects of ADHD and ethnicity but no significant ADHD by ethnicity interaction on neuropsychological composites. When SES was included as a covariate, the same pattern of main effects remained.

**Conclusions:** There is little evidence of ADHD differences that vary by ethnic group when looking at neuropsychological functioning, which implies that the neuropsychological profile of ADHD is similarly valid in AA and CA groups. One might have expected that group differences could be explained by living in a lower socioeconomic group; however, covarying SES made very little difference in the results. Future studies should test for validity differences across other ethnic groups in order to ensure that our diagnostic constructs work similarly within all cultures.

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**P.A. SUAREZ, M. CHERNER, T. GOLLAN, L. ARTIOLA I FORTUNY, I. GRANT & R. HEATON. English fluency predicts neuropsychological performance in Spanish among Spanish-speakers of Mexican descent.**

**Objective:** Studies suggest both advantages and disadvantages of bilingualism for cognitive test performance. As Spanish speakers in the U.S. vary in English fluency, it is important to understand how second language fluency may affect neuropsychological (NP) performance in the first language. To this end, we examined the effects of English fluency on Spanish language test performance.

**Participants and Methods:** Participants were 127 (73 women, 54 men) adult native Spanish speakers from the U.S.–Mexico border region. The sample’s educational attainment ranged from 0 to 20 years ( $M=9.75$ ,  $SD=4.35$ ), and their age ranged from 20 to 55 years ( $M=37.5$ ,  $SD=9.42$ ). They had normal neuromedical histories and responded to a language use questionnaire to ascertain Spanish preference. The COWAT was administered (PMR in Spanish, FAS in English) to confirm language fluency. Relative English fluency was calculated as the ratio of English words to the total produced in both languages. Participants received a comprehensive neuropsychological battery in Spanish. Effects of English fluency on test performance were examined with linear regression including age, education, sex, and years living in the U.S. as additional predictors.

**Results:** Education was a significant predictor of all of NP measures and was significantly correlated with the fluency ratio ( $r=.67$ ,  $p<.0001$ ). When controlling for education, years in the US, gender, and age, higher English fluency ratio still predicted better performance on tests of processing speed and attention/working memory, with mixed results in executive functioning and memory.

**Conclusions:** Findings suggest that English fluency may influence test performance in Spanish above and beyond the effects of education and other background factors. As such, it may need to be accounted for when interpreting test performance, adding complexity to the generation and application of test norms in bilingual groups

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**S.P. VERNEY, L.M. SILVA & J. BENNETT. Differential Predictive Validity of the WAIS-III with Reading Achievement in Ethnically Diverse Students.**

**Objective:** Historically, predictive validity has been used to determine the presence or absence of test bias. For example, IQ scores should predict an achievement measure equally for two different groups if the IQ measure holds no bias. Reading achievement tests also appear to index quality of education and have accounted for group differences on neuropsychological tests. This study investigated cognitive ability and reading achievement in ethnically diverse students.

**Participants and Methods:** European American (EA;  $n=44$ ) and ethnically diverse (ED;  $n=60$ ) undergraduate students completed the WRAT-3 Reading subtest, seven subtests of the WAIS-III, and demographic questionnaires.

**Results:** Group differences were found for the WAIS-III VIQ measure (EA:  $VIQ=107.5$ ; ED:  $VIQ=102.0$ ;  $p<0.01$ ), but not the PIQ or WRAT-3 Reading measures. Hierarchical regressions were conducted to investigate predictive validity using WRAT-3 scores (DV) and SES (step one) and both VIQ and PIQ scores (step two) (IVs). For the EA group, SES accounted for 0.1% ( $p=0.50$ ) of variance in WRAT-3 scores, and VIQ and PIQ accounted for a non-significant 6.1% ( $p=0.28$ ) of the variance over and above SES. For the ED group, SES accounted for 11.9% ( $p<0.01$ ) of variance in WRAT-3 scores, and VIQ and PIQ accounted for an additional, significant 38.9% ( $p<0.01$ ).

**Conclusions:** Strong associations were found between WAIS-III and WRAT-3 Reading scores for the ED, but not the EA students. Equal predictive validity was not found for the two groups suggesting cultural bias in the WAIS-III. If the WRAT-3 is a valid measure of quality of education, then educational disparities may exist for many ethnically diverse students.

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### Forensic Neuropsychology

**R.D. WHITMAN & E. HOLCOMB. The Relationship Between Creativity And Laterality As Examined Through A Semantic Priming Paradigm.**

**Objective:** A number of models of creativity propose either greater involvement of the right hemisphere during more creative thinking, or greater cooperation between the two hemispheres. We proposed that subjects scoring higher on measures of figural and verbal fluency and originality on the Torrance Test of Creative Abilities will show greater cross-hemisphere semantic priming. Further, we propose that this relationship will be stronger for the verbal subtests of the Torrance battery.

**Participants and Methods:** Forty-eight (19 male, 29 female) undergraduates, with normal or corrected-to-normal vision and no history of head injury or neurological problems, undergraduates were given the creativity battery and a lateralized lexical decision task consisting an English word (prime) followed by high or low associate target word or pronounceable nonword (target). All conditions were counterbalanced.

**Results:** Independent ANOVAs of each of the four categories of the Torrance battery showed significantly more priming for high associates, for right hemisphere primes, and for the prime-target interaction. Greater cross-hemisphere (than ipsilateral) priming for highly associated words was observed for subjects scoring high on verbal originality and verbal fluency, but not for figural originality or fluency.

**Conclusions:** This study confirms that both high and low creative subjects show greater semantic priming in the right hemisphere but that high creative subjects show greater cross-hemisphere priming. Further, these results differ across SOA suggesting that high creatives show early hemispheric interaction.

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### HIV/AIDS/Infectious Disease

**F. GOULD, L.H. RUBIN, J.L. WOODARD, K.M. WEBER, M.H. COHEN, E.M. MARTIN & P.M. MAKI. The Cognitive Processes Subserving the Serial Reaction Time Task in HIV+ Women.**

**Objective:** The present study aimed to characterize performance on the Serial Reaction Time task (SRT), a measure of procedural learning, in the context of HIV disease. Motor speed, processing speed and inhibition were hypothesized to designate the cognitive mechanisms supporting procedural learning as measured by SRT performance. It was hypothesized that inhibition would predict SRT performance in the HIV+ group.

**Participants and Methods:** Participants were fifty women; 35 HIV+ women and 15 HIV- controls who did not differ significantly with respect to age, education, or depression. Women were tested on the SRT, as well as on standard neuropsychological and experimental measures of inhibition, motor and processing speed.

**Results:** Mixed-effects regression models (MRMs) were used for the analyses. Random intercept and trend modeling were used to test the hypothesis that inhibitory capacity would predict SRT performance. Only processing speed entered into the model,  $F(1, 350) = 21.08$ ,  $p < 0.001$ . An additional MRM revealed that the processing speed composite not only entered into the model,  $F(1, 349) = 32.87$ ,  $p < 0.001$ , but also eliminated the serostatus effect,  $F(1, 349) = 2.42$ ,  $p = 0.12$ .

**Conclusions:** HIV+ participants are known to be vulnerable to motor speed and inhibition deficits. Yet, contrary to our hypothesis, processing speed and not inhibition predicted performance on the SRT. Therefore, motor speed and inhibition deficits may not impede performance on procedural learning tasks in HIV. Importantly, processing speed may be a more powerful predictor of performance on procedural learning tasks than serostatus.

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**J.E. IUDICELLO, S. WOODS, B.C. SCHWEINSBURG, S.L. LETENDRE, W. PERRY, R.K. HEATON, T. HASSANEIN & I. GRANT. Risky Decision Making in Adults with HCV Infection.**

**Objective:** Infection with the hepatitis C virus (HCV) has been associated with frontal systems abnormalities and neuropsychological impairment in areas such as executive functions, motor skills, and attention/working memory. HCV infection has also been associated with risky behaviors (e.g., intravenous drug use), which may be a function of either a premorbid risky decision making style and/or HCV-associated cognitive impairment. Thus, this study sought to evaluate decision making style in HCV infection.

**Participants and Methods:** Forty HCV-infected individuals and 21 healthy comparison participants were administered the Iowa Gambling Task (IGT) as part of a comprehensive evaluation. Performance was indexed by the total number of cards chosen from advantageous decks minus the selections from disadvantageous (i.e., "risky") deck across five 20-trial blocks.

**Results:** A significant time by group interaction was found for gambling task performance such that while the HCV-infected and healthy comparison groups performed comparably across the first 60 trials (all  $p's > 0.10$ ), the HCV group made significantly more risky selections ( $d=0.56$ ,  $p=0.01$ ) during the final 40-trial block, even after accounting for demographic factors that differed across groups (e.g., age, gender). Risky decision making in HCV-infected participants was not associated with psychiatric characteristics (e.g., depression), global neuropsychological impairment, substance use or HCV disease characteristics (e.g., HCV RNA).

**Conclusions:** Results suggest that HCV infection is associated with poor (i.e., “risky”) decision making. Future research should examine the underlying cognitive and neural mechanisms of decision making in HCV (e.g., associations with frontal systems), as well as their functional implications (e.g., engagement in high risk drug use behaviors).

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**C. POSADA, D.J. MOORE, M. PARIKH, O. VIGIL, B. GOUAUX, S.L. LETENDRE, C. AKE, H. ATKINSON & I. GRANT. Sustained Attention is Impaired Among HIV Infected Individuals with Bipolar Disorder.**

**Objective:** Bipolar disorder and HIV infection are both known to cause neuropsychological impairment (Bearden et al, 2001; Heaton et al, 1995). One of the most affected cognitive functions in these conditions is attention, although different aspects of attentional dysregulation have been found in the two conditions. Hitherto, no studies have attempted to study attention deficits among HIV+ individuals with co-occurring bipolar disorder (HIV+/BD). Since attention has shown to be associated with deficits in important daily functioning activities such as medication adherence (Hinkin et al, 2002), identifying specific attention deficits in this understudied population is crucial.

**Participants and Methods:** We examined 32 HIV+ and 30 HIV+/BD with the Conner’s Continuous Performance Test - II, a test of sustained attention. We also administered the Paced Auditory Serial Addition Test (PASAT), a test of complex attention.

**Results:** Groups were comparable on demographic factors, except that the HIV+/BD group had significantly more Caucasians. HIV+/BD individuals had significantly more omissions errors ( $p < 0.05$ ) and variability in attention over time ( $p < 0.01$ ) on the CPT-II as compared to individuals with HIV+. Both groups performed comparable on a test of complex attention (PASAT;  $p = 0.35$ ).

**Conclusions:** HIV+/BD individuals are significantly impaired on measures of sustained attention as compared to HIV+ individuals. These results suggest that individuals with a serious mental illness as well as HIV infection may have more basic neuropsychological impairments than those with HIV infection alone. These more basic impairments may translate into greater difficulties with daily functioning in this group.

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**R.N. ROBBINS, E. D’AQUILA, S. MORGELLO & M. RIVERA MINDT. Neuropsychological and Cultural Predictors of Adherence Among HIV+ Latinos.**

**Objective:** Adherence to antiretroviral therapy (ART) is essential in HIV/AIDS treatment. Research has examined correlates to adherence, but no one has examined neuropsychological (NP) and/or sociocultural correlates among Latinos, an at-risk population. This study examined the effects of NP functioning and acculturation on ART adherence among HIV+ Latinos.

**Participants and Methods:** 20 HIV+ Latino adults (85% male; primarily of Caribbean origin) completed comprehensive NP and neuromedical evaluations, and the Abbreviated Multidimensional Acculturation Scale (AMAS). An electronic medication monitoring device measured adherence of the most frequently dosed ART over four weeks.

**Results:** Mean adherence rate was 74.3%, with 10 participants having mean adherence rates  $\geq 95\%$ . The ‘Good Adherence’ group ( $\geq 95\%$ ) performed significantly faster on Trails A ( $p = .008$ ) and Grooved Pegboard ( $p = .003$ ; dominant and non-dominant hands, respectively) compared with the ‘Poor Adherence’ group ( $\leq 94\%$ ). Mean scores on the AMAS subscales indicated that most participants were bicultural, (i.e.,

equally identified with US and Latino cultural behaviors, attitudes and beliefs), thus restricting the range of the measure. Low US acculturation was not associated with adherence ( $p > .10$ ). However, individuals classified as 1.5 SD below the mean AMAS US identity score were more likely to be NP-impaired ( $p = .03$ ).

**Conclusions:** While the current findings are limited by a small sample size and possibly range restriction, this study is nonetheless important as it suggests that NP impairment plays a role in adherence among HIV+ Latinos, an understudied and at-risk population. The results also suggest that the effects of acculturation on adherence may be mediated through NP functioning.

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**J. SCOTT, S.P. WOODS, E. WEBER, M.S. DAWSON, M.W. BONDI, I. GRANT & T. HNRC GROUP. Combined Effects of HIV and Aging: Is the Neuropsychological Profile Similar to Alzheimer’s Disease?**

**Objective:** The incidence and prevalence of older adults living with HIV infection is increasing, and such individuals are more likely to experience morbidity and neurocognitive disorders. Given reports of increased beta-amyloid in the brains of older HIV-infected individuals, a number of researchers have suggested that aging with HIV may result in an increased risk for Alzheimer’s disease (AD). This study evaluates the hypothesis that HIV and aging interact to produce cognitive deficits similar to AD.

**Participants and Methods:** Study participants included 4 groups classified by HIV serostatus and age (i.e., younger  $< 40$  years and older  $\geq 50$  years): 1) Younger HIV- ( $n = 18$ ); 2) Younger HIV+ ( $n = 24$ ); 3) Older HIV- ( $n = 15$ ); and 4) Older HIV+ ( $n = 37$ ). Measures expected to be most sensitive to the effects of early AD were selected from a larger neuropsychological battery in the domains of episodic memory, semantic knowledge, visuoconstruction, and executive functions.

**Results:** Main effects of aging were observed on episodic learning and memory, executive functions, and visuoconstruction ( $p < .05$ ), while main effects of HIV were observed on measures of verbal learning and memory and executive functions ( $p < .01$ ). Interactive effects were only observed on measures of verbal learning ( $p < .05$ ), which post-hoc analyses showed were exclusively attributed to the superior performance of the younger HIV- group.

**Conclusions:** In this sample of older HIV-infected individuals, the additive effects of HIV and aging do not appear to result in a pattern of cognitive deficits similar to that commonly observed in AD. These findings suggest that, regardless of the underlying neuropathology, older HIV-infected persons may not exhibit the classic signs of cognitive decline associated with AD.

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**D.F. TATE, A. DELONG, K. KERTESZ, J. CONLEY, R.H. PAUL, T. RUSSELL, J. PRICE, K. TASHIMA, T. FLANIGAN & J.W. HOGAN. 12-Month History of Plasma CD4 Counts is Predictive of Attention and Executive Function Performance for HIV-Infected Patients.**

**Objective:** Cross-sectional studies examining the relationship between clinical and cognitive variables among HIV-infected patients often demonstrate equivocal results. Dynamic changes in clinical variables may limit the significance of these associations. This study examined the effect of CD4 counts modeled over a 12-month period on 18 normalized cognitive tests in a cohort of HIV-infected patients with the expectation that worse CD4 history would predict worse cognitive performance.

**Participants and Methods:** This study included 79 ethnically diverse HIV-infected patients (53%/38% Male/Black) with a mean CD4 of 433 (range 7-1518). Thirty-seven percent had detectable plasma viral

load at time of cognitive testing. A linear random effects model was used to predict subject-specific CD4 counts at testing and the slope of CD4 leading up to testing. We then examined the relationship between these trend measures and cognitive performance using multivariable linear regression.

**Results:** Statistically significant associations were found between CD4 and several tests, most prominently those within the attention and executive function domains. Attention measures were primarily positively related to predicted CD4 counts (average of 0.12 higher z-score/100 unit higher CD4 count,  $p < 0.05$ ), while executive measures were related to the slope of CD4 trajectories (average 0.5 higher z-score per 10 unit CD4 increase/month),  $p < 0.05$ ). No significant associations with language, memory, and motor function tests were found. Effect sizes remained essentially the same when models were adjusted for several potentially confounding covariates including medication type, ethnicity, and plasma viral load at time of testing.

**Conclusions:** These results suggest that trends in the recent patient immunological history are important predictors of cognitive function for attention and executive function domains.

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#### D.E. VANCE. A Comparison of Cognitive and Everyday Functioning in Younger and Older Adults with and without HIV.

**Objective:** An increasingly important issue in neuropsychology is the growing risk of cognitive impairment in older adults infected with HIV and its possible effects on everyday functioning. The purpose of this study was to: (1) examine cognitive performance differences in older and younger adults with and without HIV, and (2) determine if such differences were related to a laboratory measure of instrumental activities of daily living (IADLs).

**Participants and Methods:** In a cross-sectional design, 98 HIV-positive (69 below 50 years of age; 29 50 years or older) and 103 HIV-negative (84 below 50 years of age; 19 50 years or older) adults were evaluated on a number of cognitive measures covering a variety of domains including memory, attention, speed of processing, executive functioning, and psychomotor ability. The Timed Instrumental Activities of Daily Living (TIADL) task was used as a laboratory measure of everyday functioning.

**Results:** Controlling for gender, sexual orientation, education level, reading ability, household income, Profile of Mood States total, number of medical conditions, number of medications, and psychoactive drug use, age by HIV status interaction were found on five out of twelve cognitive measures, indicating poorer cognitive performance for those aging with HIV. Poorer performance on these cognitive measures corresponded with poorer performance on the TIADL.

**Conclusions:** These findings suggest that as adults age with HIV, they may be at risk for cognitive declines that would impair their ability to engage in activities vital for maintaining independent living. Implications for cognitive remediation and preventing cognitive decline are posited.

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#### M. WARDLE, R. GONZALEZ, A. BECHARA & E. MARTIN-THORMEYER. Neurocognitive Functioning and Depression Interact to Predict Risky Sexual Behaviors in HIV+ Substance Dependent Individuals.

**Objective:** Identifying factors contributing to risky sexual behavior in HIV+ substance dependent individuals (SDIs) is important to reducing HIV transmission. Previous research suggests sensation-seeking predicts sexual risk in HIV+ SDIs with better decision-making, but not in those with poorer decision-making (Gonzalez et al., 2005). We extend this finding by exploring interactions of depression with decision-making on sexual risk in HIV+ SDIs.

**Participants and Methods:** Participants were 234 HIV+ polysubstance users meeting DSM-IV criteria for history of drug abuse or dependence, who were Breathalyzer and urine toxicology screened to ensure recent abstinence. We assessed decision-making with the Iowa Gambling Task (IGT), depression with the Beck Depression Inventory (BDI), and sexual risks with the Risk Assessment Battery.

**Results:** Multiple regression analyses examined effects of depression and decision-making on sexual risk, controlling for demographics, drug history and personality factors. IGT and BDI scores had no main effect, but a significant interaction appeared, such that higher BDI related to increased sexual risk among good performers on the IGT, but not poorer performers.

**Conclusions:** Paralleling Gonzalez et al. (2005), it appears depression influences sexual risk, but only in HIV+ SDIs with better decision-making. An important implication is that risk-reduction strategies aimed at controlling depression are more likely to be effective in HIV+ SDIs with intact decision-making.

Supported by the National Institute on Drug Abuse.

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#### S.P. WOODS, E. WEBER, M. DAWSON & I. GRANT. HIV-associated Prospective Memory Impairment in the Laboratory Predicts Real-World Failures to Execute a Future Intention.

**Objective:** HIV infection is associated with mild-to-moderate impairments in prospective memory (i.e., ProM or "remembering to remember"), which is posited to increase the risk of dependence in everyday functioning. The present study evaluated the hypothesis that HIV-associated ProM impairment in the laboratory is predictive of real-world failures to execute a future intention.

**Participants and Methods:** Participants were 143 individuals with HIV infection who underwent comprehensive medical, psychiatric, and neuropsychological assessments, including a laboratory-based measure of ProM (i.e., Memory for Intentions Screening Test (MIST)). To assess real-world ProM behaviors, participants were instructed to call the examiner 24 hours after their evaluation and report how many hours they had slept the night of the assessment. No restrictions (or recommendations) were given regarding the use of mnemonic strategies for this semi-naturalistic telephone task.

**Results:** Individuals who failed to correctly execute the telephone instruction ( $n=108$ ) demonstrated significantly lower performance on both the time- and event-based subscales of the MIST ( $p < .05$ ,  $d \sim 0.5$ ) as compared to participants who successfully completed the call ( $n=35$ ). Importantly, the MIST remained a significant predictor of failure on the real-world telephone task, even after accounting for the potentially confounding effects of demographics (e.g., education), psychiatric distress (e.g., depression), and general cognitive functioning.

**Conclusions:** Results from this study suggest that HIV-associated ProM impairment in the laboratory is an independent predictor of real-world failures to execute a future intention, despite no restrictions being placed on the use of mnemonic strategies. Findings extend prior research supporting the ecological relevance of ProM functioning in various clinical populations. Correspondence: *Steven P. Woods, UC San Diego, 150 W. Washington Street, San Diego, CA 92103. E-mail: spwoods@ucsd.edu*

#### Other

#### M.M. DE MARTINO & M.L. BASTO. EMOTIONAL STATES AND QUALITY OF SLEEP AMONG NURSES WORKING ON ROTATIONAL SHIFTS IN A EUROPEAN HOSPITAL.

**Objective:** This research aimed to analyze emotional states and quality of sleep among Portuguese nurses through the Pittsburgh questionnaire - Sleep Quality Index (PSQI).

**Participants and Methods:** Seventy-two voluntary subjects aged 29 to 41 years participated in this study. At the beginning of their shiftwork, the nurses answered the questionnaires about quality of sleep and the list of emotional states (Engelmann, 1976).

**Results:** The analyses indicated the presence of stable emotional state, and the comparisons with the quality of sleep through the Pittsburgh sleep quality index showed significant associations. The descriptive analyses regarding the locutions reported by the subjects – ‘I have resigned’, ‘I am sleepy’ and ‘I feel obligated’ –, when compared with the good quality sleep (PSQI), showed statistical significance by the Mann-Whitney test ( $p < 0.05$ ).

**Conclusions:** The groups of subjects under 30 years of age woke up ( $p < 0.0001$ ) later and showed a higher amount of sleep in comparison with the group over 30 years of age ( $p = 0.0052$ ); therefore, there was an age interference, showing that the older one becomes there is a need to sleep more. The quality of sleep was bad when if comparison in the other research in Brazil which nurses.

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#### B. FERGUSON, V. DRAGO, K. SPRUYT, K.M. HEILMAN & P.S. FOSTER. Creativity and Sleep Disturbance.

**Objective:** Disturbance of the noradrenergic and serotonergic systems are known to give rise to sleeping disturbances. Additionally, these neurotransmitter systems are also implicated in creative processes. For instance, administration of propranolol, a beta-adrenergic antagonist, has been found to enhance cognitive flexibility. Further, creative individuals have been found to possess significantly lower concentrations of both norepinephrine and dopamine relative to individuals with lower creativity. We sought to investigate whether individuals with sleep disturbance have increased creativity. We predicted that sleeping problems would be associated with increased creativity.

**Participants and Methods:** A total of 54 individuals completed the Pittsburgh Sleep Quality Index (PSQI), as a measure of sleep disturbance, as well as the Abbreviated Torrence Test for Adults (ATTA) and the Scale of Creative Attributes and Behavior (SCAB), as measures of creativity. Performance on the PSQI was used to create two groups of individuals, those with lower sleep quality (LSQ: PSQI < 7) and those with higher sleep quality (HSQ: PSQI > 7).

**Results:** The results indicated that the LSQ group scored significantly higher on the SCAB ( $M = 109.03$ ,  $SD = 12.76$ ) than the HSQ group ( $M = 101.55$ ,  $SD = 17.04$ ). Further the LSQ group performed significantly higher on activity one (verbal) of the ATTA ( $M = 10.42$ ,  $SD = 4.77$ ) than the HSQ group ( $M = 7.68$ ,  $SD = 3.22$ ).

**Conclusions:** Hence, consistent with our hypotheses, individuals with sleeping problems possess increased creativity. However, future research should explore whether chronic or more acute levels of sleep disturbance are association with differential effects on creative processes.

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#### L.S. KAKOS, J. GUNSTAD, E. GLICKMAN, T. ALEXANDER, M. SPITZNAGEL, J. JUVANCIC-HELTZEL, K.M. STANEK & A.J. SZABO. Ghrelin is Associated with Cognitive Function, Fitness, and Appetite in Healthy Older Adults.

**Objective:** Ghrelin is an appetite-stimulating hormone that is important for weight regulation and weight loss. Recent work demonstrates that obesity adversely impacts cognitive function in older adults and that ghrelin is implicated in brain areas important for cognition. Therefore, we examined whether ghrelin might be associated with cognitive function, fitness, and appetite in healthy older adults.

**Participants and Methods:** 35 healthy older adults (average age  $73.9 \pm 6.6$ ) underwent brief cognitive testing, fitness assessment, and blood draw as part of a larger study. For the current study, the association between ghrelin and the Modified Mini Mental Status Examination (3MS; cognitive screening), Rapid Assessment of Physical Activity (RAPA; physical fitness), and the Council on Nutrition Appetite Questionnaire (appetite) were examined using partial correlations adjusting for BMI, sex, age, and years of education.

**Results:** Partial correlations showed higher ghrelin levels were associated with poorer performance on the 3MS ( $r = -.48$ ,  $p = .01$ ). Higher ghrelin levels were associated with less frequent strength/flexibility exercises (RAPA;  $r = -.42$ ,  $p = .01$ ). Finally, contrary to findings in younger adults, higher levels of ghrelin were found in persons reporting lower appetite levels ( $r = -.38$ ,  $p = .03$ ).

**Conclusions:** The current findings indicate that ghrelin is associated with cognitive function, fitness, and appetite in older adults. However, further work is needed to clarify these findings, particularly the negative association between ghrelin and appetite in older adults.

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## THURSDAY MORNING, FEBRUARY 12, 2009

### Paper Session 3: Normal Aging

9:00–10:30 a.m.

#### M. MENCHOLA, K.L. BERGFELD, K.D. HANSON, K. CHEN, E.M. REIMAN, R.J. CASELLI & G.E. ALEXANDER. Multivariate Network of Mri Gray Matter Associated with Healthy Cognitive Aging.

**Objective:** Studies of healthy aging suggest declines in frontal lobe-mediated neural systems involved in aspects of attention, memory, and executive function. We used multivariate network analysis to identify a pattern of magnetic resonance imaging (MRI) gray matter associated with healthy aging, and tested its relation to neuropsychological performance and apolipoprotein E (APOE) genotype, a common susceptibility gene for Alzheimer’s disease (AD).

**Participants and Methods:** We acquired T1-weighted volumetric MRI scans in 65 cognitively normal individuals with reported family history of dementia, ages 26–71 (mean age =  $52 \pm 12$ ; M/F = 23/42; APOE  $\epsilon 4$  homozygotes/heterozygotes/non-carriers = 16/26/23). MRI scans were nor-

malized, segmented, and smoothed with optimized SPM5 voxel-based morphometry (VBM) using customized tissue priors, to produce gray matter volume maps. We used the Scaled Subprofile Model (SSM) with MRI VBM and bootstrap re-sampling to characterize the age-associated regional network pattern of gray matter.

**Results:** SSM analysis identified a linear combination of four components associated with age ( $R^2 = 0.69$ ,  $p < 0.000001$ ). The combined pattern was characterized by bilateral gray matter reductions in medial and dorsolateral pre-frontal and superior temporal/insular regions, with relative preservation bilaterally in cingulate and basal ganglia areas. This age-related pattern was not associated with APOE genotype ( $p = 0.175$ ). Higher pattern expression was associated with poorer performance on the Bushke Selective Reminding Test, Trails B, and Stroop interference condition ( $p$ ’s  $< 0.007$ ), but not with Boston Naming, Trails A, or Stroop non-interference.

**Conclusions:** In this sample, healthy cognitive aging was characterized by reductions of gray matter in frontal and selective temporal brain regions and their associated neuropsychological functions, which were not attributable to an APOE-related risk for AD.

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**R.A. CHARLTON, F. SCHIAVONE, T.R. BARRICK, R.G. MORRIS & H.S. MARKUS. Changes in Cognitive Abilities and MRI in Normal Aging After a Two-Year Delay.**

**Objective:** White matter damage occurs in normal aging, and is associated with cognitive decline particularly in executive function. Diffusion tensor imaging (DTI) is a sensitive measure for detecting white matter damage, and in cross-sectional studies correlates with cognitive abilities thought to depend on white matter connectivity. There is little data on whether DTI can detect change over short time-periods, and whether this correlates with cognitive changes.

**Participants and Methods:** In a community sample of 84 middle-aged and elderly adults MRI and cognitive testing was performed at baseline and after two-years. Executive function, working memory and information processing speed were measured; DTI white matter histograms, white matter hyperintensity (WMH) volume and brain volume were determined. Cognitive measures were correlated with MRI parameters.

**Results:** At baseline, both MRI and cognitive measures correlated negatively with age. On multivariate analysis of MRI parameters only DTI independently correlated with the three cognitive domains. During follow-up significant change in all MRI measures was detected. For cognition, change was only detected for working memory and this correlated with change in DTI but not WMH or brain volume.

**Conclusions:** Working memory is sensitive to change over a two-year period in normal ageing. MRI changes are detectable over this period, but only change in DTI measures correlated with change in working memory. DTI is sensitive to age-related change in white matter ultrastructure and appears useful for monitoring age-related white matter.

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**M. LAMAR, W.J. CUTTER, K. RUBIA & D.G. MURPHY. Acute Tryptophan Depletion Promotes an Anterior-Posterior fMRI Activation Shift in Aging During Tasks of Cognitive Control.**

**Objective:** Evidence suggests a posterior-anterior shift in aging across measures of attention, working memory and episodic encoding with an opposite pattern of results (i.e., anterior-posterior shift) observed in regions of increased age-related vulnerability such as the orbitofrontal cortex. Age-related declines (i.e., vulnerability) in prefrontal serotonin (5-HT) are documented. The effect of 5-HT on prefrontal cortex (PFC) is also documented; however, no one has examined the effect of experimental 5-HT modulation on PFC in healthy older adults.

**Participants and Methods:** We investigated the effect of 5-HT on brain functioning in 10 women over 55 (mean=63.0±5.3yrs) during cognitive control tasks of interference inhibition (Simon task) and set shifting (Switch task) using fMRI and acute tryptophan depletion (ATD) to assess if vulnerability within the 5-HT system would also promote an anterior-posterior shift.

**Results:** ATD did not affect task performance; it did affect brain function. During sham/no depletion, participants activated brain regions traditionally associated with each task (e.g., Simon=left inferior PFC; Switch=bilateral medial PFC). During ATD, however, there was no prefrontal activation but alternative posterior brain activation. For example, ATD relative to sham during the Simon reduced activity in left inferior PFC, anterior cingulate and basal ganglia but increased activity within neocerebellum and parietal lobe. Increased neocerebellar activation was also seen in ATD relative to sham during the Switch.

**Conclusions:** Across measures, ATD modulated task-relevant brain activation and was associated with an anterior-posterior activation shift in healthy older adults. Maintaining successful cognitive control during ATD is achieved by increasing neocerebellar contributions to compensate for decreased fronto-cingulate-striatal involvement.

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**S.L. WILLIS, E. AYLWARD, K. WEAVER, O. LIANG, R. ELLENBOGEN & W. SCHAIE. Association of Midlife Cognitive Decline and Brain Volume.**

**Objective:** Longitudinal studies report normative patterns of stability in cognition during midlife. However, prospective dementia studies report preclinical changes in cognition occurring as early as midlife. In this study we examine the group differences in brain volume for individuals exhibiting either cognitive decline or cognitive gain in midlife.

**Participants and Methods:** Seattle Longitudinal Study subjects (n = 653) were assessed on an extensive psychometric ability battery at 3 occasions in midlife (age 43 – 63). Subjects' midlife trajectories on three abilities (executive functioning, verbal memory, psychomotor speed) were characterized as indicating reliable decline, gain, or stability. While midlife trajectories were stable for most subjects, approximately 10-15% of subjects showed reliable decline or gain. Decliners and gainers did not differ in age or education. Structural MRI scans (total brain, total gray matter, total white matter, right and left hippocampus) were conducted on a subset of n = 165 subjects who declined or gained cognitively in midlife and who were currently in midlife (n = 87) or old age (n = 78).

**Results:** Analyses of covariance (Intracranial volume, covariate) indicated significant differences in brain volume for those showing midlife decline vs gain on executive functioning. Those declining in midlife on executive functioning had significantly smaller total brain volume (p < .01), total white matter volume (p < .01), and total gray matter volume (p < .03).

**Conclusions:** Findings show associations between midlife cognition and brain volume.

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**T.D. VANNORS DALL, G.D. PEARLSON, B. GORDON & D.J. SCHRETLEN. White and Grey Matter Correlates of Processing Speed in Healthy Adults.**

**Objective:** Both normal aging and many neuropsychiatric conditions dramatically decrease speed of simple information processing. Neuroimaging research has focused on associations between speed and white matter (WM) integrity. Less attention has been paid to the contribution of cortical grey matter (GM). We conducted a whole-brain analysis of regional WM and GM volumes to explore the neuroanatomic bases of individual differences in processing speed.

**Participants and Methods:** Healthy adults (N = 138) aged 20 to 96 years (M = 55; SD = 18) underwent a brain MRI scan and completed tests of processing speed (Digit Symbol, Perceptual Comparison) that were linearly transformed to yield a composite processing speed index. Voxel-based morphometry was used to examine correlations between brain WM and GM volumes and processing speed after adjusting for age, sex, and handedness. We used a 25-voxel extent threshold and false discovery rate (p < 0.05) to control for multiple comparisons.

**Results:** Performance on the processing speed index correlated positively with widespread WM. Relatively smaller but widespread associations with GM volume also emerged.

**Conclusions:** These findings confirm previous reports that processing speed depends heavily on the integrity of cerebral WM tracts, even after accounting for age. In addition, they show that age-independent differences in processing speed also correlate with regional GM volumes throughout the brain. Perhaps it is this very dependence on such widespread WM and GM structures that accounts for the remarkable sensitivity of processing speed to the effects of normal aging and so many different brain diseases, injuries, and conditions.

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**Invited Plenary:  
Individual and Species Differences in the Control  
of Attention**

**Speaker: David Washburn**

**9:00–10:00 a.m.**

**D.A. WASHBURN. Individual and Species Differences in the Control of Attention.**

Attention is a multidimensional cognitive construct that subsumes several distinct but interrelated skills or processes, including focusing, scanning, and sustaining. Individuals differ in the use of attention along these intensive, spatial, and temporal dimensions, and those individual differences can be predictive of performance on a variety of criterion tasks. Groups, including species, can also differ in performance on each of these factors of attention. That is, nonhuman animals such as rhesus monkeys can perform tests of executive attention, orienting, and alerting, and produce patterns of responding that are comparable to those observed for human adults and children. What then distinguishes the attention skills of humans and nonhuman primates? Rhesus monkeys and humans were tested on a battery of computerized tasks under conditions designed to induce response competition between three potential sources of cognitive control: executive constraints (motivations, instructions), experiential constraints (priming, conditioning), and environmental constraints (novelty, movement). The battery included common tests of attention, such as the Stroop task, a flanker task, a visual search task, and an antisaccade task. Across these experiments, it was clear that these three constraints vie for control over attention in both species. However, the reliable finding was that monkeys were less capable than humans of executively controlling attention, and were more subject than humans to environmental and experiential control of attention. These findings have implications for developmental changes that are observed in human attention, and also for interventions that can be attempted for populations at risk for attention deficits. (Supported by NICHD-38051.)

Correspondence: *David A. Washburn, Ph.D., Psychology and Neuroscience, Georgia State University, Box 5010, Atlanta, GA 30302-5010. E-mail: lrcaur@langate.gsu.edu* **Symposium 3:  
Exploring Applications of Cognitive Efficiency in  
Children and Adults with Mild TBI.**

**Chair: Gerard Gioia**

**Discussant: Caroline Roncadin**

**9:00–10:30 a.m.**

**G.A. GIOIA, C. RONCADIN, M. LOVELL, C. VAUGHAN, P. ISQUITH & C. RONCADIN. Exploring applications of cognitive efficiency in children and adults with mild TBI.**

**Symposium Description:** In mild TBI, cognitive functioning may be impaired in subtle ways that can be difficult to detect with standard measures and metrics. In traditional assessment, many contemporary clinical neuropsychological tasks record response time and accuracy separately, examining these scores in parallel. More recently, there has been increased interest in efficiency of cognitive processing, that is, a metric that combines both speed and accuracy. In their 2007 JINS paper, Roncadin and colleagues demonstrated an innovative measure of cognitive efficiency on experimental computerized tasks of working memory and inhibitory control in a typical developmental sample. Their formulation combined response latency and accuracy to calibrate efficiency dur-

ing task performance in order to optimize the trade-off between speed and correctness. This measure enabled analysis of efficiency both within and between tasks. In the course of developing computerized neuropsychological batteries for use in assessing cognitive impairment relative to norms as well as intra-individual change over time (e.g., brain injury recovery), our group has attempted to apply a similar scoring methodology to capture performance efficiency. In this symposium we present four applications of the cognitive efficiency construct across pediatric and adult samples of mild TBI. Variations of efficiency scores were formulated to capture the speed-accuracy trade-off while taking into account the cognitive processing properties of the tasks as well as the range of latency and accuracy data obtained from normative samples. The symposium will conclude with a discussion of the common and distinct aspects of measuring performance efficiency across the lifespan and their potential clinical applications.

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**M. LOVELL. Cognitive efficiency in adult athletes with concussion.**

**Objective:** Organized athletics provides an excellent laboratory for studying mild traumatic brain injury (concussion). Over the past decade, numerous studies have examined the use of neuropsychological assessment techniques to monitor acute recovery following sports-related concussion. Recent application of computer-based neuropsychological screening tools has played an important role in this area of research. In addition to evaluating the traditional domain of memory, computer based approaches allow for more precise measurement of cognitive speed, recorded at higher levels of accuracy than possible through traditional means (e.g. stopwatch). The ImPACT computer-based test battery was designed to capture the interplay between cognitive speed and memory (cognitive efficiency). Within this context, cognitive efficiency incorporates both accuracy and speed. This is important because concussed athletes may sacrifice either speed or accuracy when faced with a difficult task.

**Participants and Methods:** This study evaluated the interplay between speed and accuracy on the Symbol Match subtest of ImPACT. Symbol Match is similar to Symbol Digit Modalities but measures response time in milliseconds. This task also includes the number of items accurately recalled. For this study, a Cognitive Efficiency Index score was calculated for a sample of 252 concussed athletes. This clinical group was compared to an age-matched control group (N=85).

**Results:** Concussed athletes performed significantly more poorly than did non-injured athletes on the CEI ( $p < .02$ ).

**Conclusions:** The CEI provides useful information regarding the trade-off between speed and accuracy. This measure may provide a useful metric of the evaluation of recovery post-injury.

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**C. VAUGHAN, P. ISQUITH & G. GIOIA. Examining Two Methods of Cognitive Efficiency Following Mild TBI in the Developing Child.**

**Objective:** To study reaction time, accuracy, and cognitive efficiency (e.g., a speed/accuracy trade-off) in detecting cognitive sequelae of a concussion in the developing brain. Two different efficiency indices were employed and the findings using both indices were compared.

**Participants and Methods:** 512 typically developing children age 5 to 12 completed the Pyramid Code subtest of the Pediatric ImPACT test battery, providing incidental learning and response time scores. A Cognitive Efficiency Index (CEI) score (Lovell, unpublished) and Efficiency Index Ratio (EIR) (Roncadin, et. al., 2007) were calculated.

**Results:** There were large differences in response times between the two groups but no differences in accuracy. Both efficiency formulas ( $p < .01$ ) captured strong developmental trends across the age range. There were significant EIR differences between a sample of concussed and non-concussed children (age and gender matched;  $n = 34$ ) for the EIR, but not for the CEI.

**Conclusions:** Response time is adversely effected following concussion but not necessarily accuracy, depending on the task demands. Two efficiency indices successfully captured developmental differences in the speed/accuracy tradeoff. One index, the EIR, captured differences in efficiency between concussed and non-concussed children. This index, utilizing a developmentally sensitive corrective factor, may increase sensitivity slightly although reaction time continues to remain the largest differential factor between the two groups on this particular task.

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#### P. ISQUITH. Cognitive efficiency in children in working memory with typical and mTBI children.

**Objective:** We examined application of a cognitive efficiency index versus speed and accuracy measures for children with mild TBI on a computerized test of working memory and inhibitory control.

**Participants and Methods:** 36 boys and 23 girls with mTBI aged 5-18 years completed a novel computerized task along with 614 typically developing boys and 362 girls. The task combined an N-back paradigm (0, 1-back) to assess working memory with a go/no-go paradigm to assess inhibitory control across 4 conditions. We calculated response time (RT), accuracy (ACC), and cognitive efficiency index (CEI) scores, using the methodology of Roncadin et al (2007).

**Results:** Simple ACC and RT in the non-injured group increased with age ( $\eta^2=.30$ ). Girls were slower ( $\eta^2=.07$ ) but more accurate ( $\eta^2=.04$ ). The CEI showed an interaction between age and gender ( $\eta^2=.27$ ), favoring boys at a younger age but evening out by age 9. Children with mTBI were slower no differences in accuracy. The CEI reflected this ( $\eta^2=.03$ ) with less efficiency in the mTBI group. Of interest, response variability in the mTBI group was five times greater than for the typically developing children.

**Conclusions:** The cognitive efficiency index captures both developmental and group differences in the speed/accuracy tradeoff. This varies by age, as the cognitive capacity of younger children just meets task demands resulting in larger speed and accuracy tradeoffs with girls favoring accuracy over speed. Once capacity exceeds demands of the task, differences in speed/accuracy balance are less noticeable. In clinical groups, however, the CEI remains sensitive to speed decrements despite no changes in accuracy. Correspondence: Gerard A. Gioia, Ph.D., Pediatric Neuropsychology, Children's National Medical Center, 14801 Physician's Lane, Suite 173, Rockville, DC 20850. E-mail: ggioia@cnmc.org

#### C. RONCADIN. Performance efficiency in working memory and inhibitory control tasks in children who sustained a mild closed head injury.

**Objective:** To apply a performance efficiency scoring methodology for the evaluation of working memory (WM) and inhibitory control (IC) abilities during the chronic recovery phase after sustaining a mild closed head injury (CHI) early in life.

**Participants and Methods:** Twelve children ranging in age at testing from 7 to 11 years who sustained a mild CHI at least 4 years earlier were compared to 12 controls matched in age, sex, and full-scale IQ on two WM (maintenance, manipulation) and two IC (simple, complex) tasks. A measure combining response latency and accuracy was formulated to evaluate overall performance efficiency within tasks. Cohen's d effect sizes were compared between each group on the four tasks.

**Results:** The CHI group had lower mean efficiency scores on all tasks. The comparisons of efficiency between the groups yielded small but notable effect sizes.

**Conclusions:** Children who sustained a mild CHI early in life exhibit subtle inefficiencies in the deployment of WM and IC resources, which are captured using a measure of performance efficiency that combines response speed and accuracy. These impairments may progressively disadvantage children with a history of early CHI later in life as higher-order cognitive functions come on line.

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## Poster Session 2: Memory, Psychopathology/Neuropsychiatry, Drugs/Toxins

9:00–10:30 a.m.

### Assessment/Psychometrics/Methods (Adult)

S. TREWORGY, K. POLLARD, K.J. MILLER, V. FERLA, J. KIM, L. ERCOLI, A. KAPLAN, D. DORSEY & G.W. SMALL. Neurological Assessments Which Best Predict Cognitive Status in Older Adults in Association with Age and Cognitive Reserve.

**Objective:** Our group's recent research has shown that age, cognitive reserve, and scores on the Buschke Selective Reminding Task may be strong predictors of cognitive status among older adults. The purpose of the current study is to explore which combination of neuropsychological assessments, in association with age, education, and pre-morbid IQ, predict cognitive status group membership.

**Participants and Methods:** Participants (N=113), including 73 women, were divided into three groups by age (M age = 63.05, SD = 9.24), and then into three groups according to cognitive status (intact cognition, mild cognitive impairment (MCI), and dementia).

**Results:** Discriminant Function Analyses were conducted using the predictors of age, pre-morbid IQ, and education level consistently in association with combinations of neuropsychological assessments to predict correct classification into the cognitive status groups. The following correct classification percentages were found for the respective additional predictors: 94.4% with Verbal Paired Associates (VPA), Buschke and Mini Mental Status Exam (MMSE); 93.7% with MMSE, WMS-III - Logical Memory (LM) and VPA; 92.6% with VPA and Buschke; 91.9% with Trails A and B, VPA, and the MMSE; 90.1% with VPA and MMSE.

**Conclusions:** The results suggest that abbreviated combinations of cognitive assessment batteries show success in determining cognitive status (intact, MCI, dementia) in older adults. The prediction of cognitive status was impressive with overall classification rates ranging from 90.1 to 94.4 for the most successful combinations of predictive factors. These findings may help to develop efficient abridged neuropsychological testing batteries for clinical or research settings where additional testing may or may not be necessary.

Correspondence: Shanna Treworgy

### Drug/Toxin-Related Disorders (Including Alcoholism)

M. CHERNER, P. SUAREZ, T. MARCOTTE, J. ATKINSON, I. GRANT & R. HEATON. Length of Abstinence is Unrelated to Neuropsychological Performance in Methamphetamine Dependent Adults.

**Objective:** Methamphetamine (meth) dependence is a public health concern and can be associated with neuropsychological (NP) deficits. We investigated the role of length of abstinence on NP test performance.

**Participants and Methods:** Participants were 39 men and 14 women diagnosed with meth dependence according to DSM-IV criteria. All were seronegative for HIV or hepatitis C and had negative urine toxicology for stimulants on the day of assessment. Participants were requested to maintain a minimum of 10 days of abstinence prior to NP testing. Spearman correlations were calculated between days abstinent and NP T-scores on a battery of 15 tests encompassing 7 ability domains.

**Results:** On average, the group consumed 383 (sd=360) grams of meth annually for 12 (5.3) years. Median self-reported length of ab-

stinence was 92 days [IQR: 57-180, range 10-395]. Forty-one percent were NP impaired according to clinical ratings based on demographically adjusted test T-scores. Average abstinence for impaired participants was 125 (96) days and 131 (103) for normals. Correlations between days abstinent and NP test scores ranged from  $-.17$  to  $.17$  and none were statistically significant. Dividing the sample into subgroups based on length of abstinence likewise revealed no significant differences in test scores or percent globally impaired [10-30 (57%), 31-60 (30%), 61-90 (33%), 91-120 (29%), 121-180 (44%), 181+ (45%)].

**Conclusions:** Although a substantial proportion of currently abstinent meth addicts were cognitively impaired, length of abstinence was unrelated to test performance. This can be interpreted to suggest that meth-associated brain dysfunction is longstanding once it occurs, or alternatively, that there are individual differences in vulnerability and recovery of functions after prolonged meth exposure. Within-subjects longitudinal designs with larger samples are required to explore these potential differences.

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### J. ENGLE & K.A. KERNS. Probabilistic Reinforcement Learning in Children with Fetal Alcohol Spectrum Disorder (FASD).

**Objective:** Clinical wisdom suggests that children who are affected by prenatal alcohol, even those with intelligence in the average range, do not appropriately alter their behavior in response to consequences. Caregivers note that these children make the same mistakes over and over despite rewards for “good” behavior or punishment for “bad” behavior. Though this prevailing notion has had a profound impact on advice given to caregivers, as yet it has received surprisingly little research attention. This study was designed to empirically examine reinforcement learning in children with FASD.

**Participants and Methods:** Participants included 18 children with FASD (ages 11-17), and 18 matched Controls. The novel computerized paradigm in this study consisted of 2 pairs of abstract images, with the correct images rewarded on 70% of trials. Each participant completed the paradigm under 2 conditions (counterbalanced) which varied in abstractness (tokens received versus ‘points’ on screen).

**Results:** The Control group showed an overall higher percent correct compared to the FASD group (Cohen’s  $d=1.03$ ). Within and between tasks, both groups showed similar improvement. Parent-reported attention problems & transfer of learning skills were significantly correlated with task performance. Overall within-group comparisons showed no significant differences between the 2 types of reinforcement, though post-hoc analyses revealed that the Control group scored significantly higher than the FASD group in the points, but not the tokens, condition.

**Conclusions:** Reinforcement learning skills were associated with better attention and transfer of learning skills. Children with FASD were slower to learn from reinforcement compared to Controls, although improvement with repetition was evident in both groups.

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### C.B. FORTIER, E.C. LERITZ, D.H. SALAT, J.R. VENNE, A.L. MAK-SIMOVSKIY, C.E. CHAPMAN & R.E. MCGLINCHEY. Associative Learning and MRI Correlates in Abstinent Alcoholics and Normal Participants.

**Objective:** To relate comprehensive structural MRI data (high resolution T1-weighted structural images) and morphometric information (volumes of subcortical structures including cerebellar gray and white matter, as well as measures of cortical thickness), to associative learning performance during a complex eyeblink classical conditioning task: discrimination and reversal learning.

**Participants and Methods:** During discrimination learning one tone (CS+) predicted the occurrence of an airpuff (US) while another tone (CS-) served as a neutral stimulus, then the significance of the tones reversed. Analyses were performed on a combined group of abstinent alcoholics (ALC) and normal control participants (NC) (26 ALC, 13 NC) and were corrected for intracranial volume.

**Results:** We found significant correlations between learning performance and brain regions known to support successful learning. Reversal learning was significantly correlated with a measure of cerebellum white matter in both the left ( $r=.462$ ) and right ( $.466$ ) hemispheres. Discrimination learning was significantly correlated with the left ( $r=.393$ ) and right ( $r=.407$ ) thalamus; as was reversal learning with the left ( $.504$ ) and right ( $.466$ ) thalamus. A number of correlations were found between measures of learning and left hemisphere premotor areas. Pars opercularis was associated with acquisition of CR’s during reversal learning ( $r=.405$ ) and the reversal score ( $r=.332$ ). The pars orbitalis was associated with discrimination and reversal learning ( $r=.355$ ,  $r=.322$ ). Pars triangularis was significantly associated with reversal learning ( $r=.370$ ). Lastly, the frontal pole was related to the inhibition of producing a CR during nonreinforced trials on both the left ( $r=.343$ ) and right ( $r=.369$ ).

**Conclusions:** These data are consistent with the feedback loop of cerebrocerebellar system composed of the cerebellar corticonuclear projections from the cerebellar nuclei through the red nucleus to the thalamus, and ultimately the thalamocortical relay.

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### R. GONZALEZ, J. VASSILEVA & E.M. MARTIN-THORMEYER. Neurocognitive Disinhibition and Cannabis Addiction: a Pilot Study.

**Objective:** To examine relationships among three measures of neurocognitive disinhibition (NcD) and indices of past cannabis use and addiction symptom severity.

**Participants and Methods:** Participants were 96 adult HIV-seronegative polysubstance users with history of cannabis use. All were abstinent at testing, and none met DSM-IV criteria for any current substance use disorder. NcD was assessed with a Stop-Signal, Go-NoGo, and Temporal Discounting task. Data analyses controlled for several relevant demographic and mental health confounds.

**Results:** Multiple linear regression revealed that amount of past cannabis use was not associated with NcD. Three additional regressions included as independent variables one of the three NcD measures, amount of cannabis use, and their interaction effect. The dependent variable was severity of cannabis addiction, as assessed by the Severity of Dependence Scale for Cannabis (SDS-C). As expected, amount of cannabis use was significantly associated with SDS-C scores ( $p$ -values  $< 0.0001$ ; std Betas =  $.36$  to  $.41$ ). Performance on the Go-NoGo task also accounted for unique variance in the SDS-C, with better performance associated with less severe cannabis addiction (std Beta =  $-.19$ ,  $p = .03$ ). Additionally, a significant interaction was observed between amount of cannabis use and Stop-Signal performance. Heavy users of cannabis showed no relationship between Stop-Signal performance and the SDS-C; but, among the lighter cannabis users, poorer Stop Signal performance was significantly associated with greater cannabis addiction severity ( $r = .40$ ;  $p = .003$ ).

**Conclusions:** NcD demonstrates complex relationships with severity of cannabis addiction, but does not show a direct relationship with amount of past cannabis use.

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### Y. HSU & M. HUA. Midazolam-Induced Cognitive Impairments and Treatment Effects of Flumazenil in Day-Case Colonoscopy Patients.

**Objective:** Midazolam is a widely used sedative with an antagonist Flumazenil capable of reversing tranquilizing effect. However, issues of

Midazolam-induced the cognitive change profile and the reversibility of Flumazenil on the impaired functions have been unsettled. Heterogeneity of individuals' drug reactivity might contribute to these controversies. Using intrapersonal analysis procedure, the present study was thus to re-examine these subjects.

**Participants and Methods:** In experiment 1, 30 patients receiving sedative colonoscopy were recruited. Each subject received a battery of neuropsychological tests including orientation, sustained attention, psychomotor speed, memory, working memory, and executive functions at entry of the study (T1), and at 15 (T2) and at 120 (T3) minutes after receiving Midazolam infusion. In experiment 2, 51 patients with Midazolam injection were randomly assigned to receive 0mg, 0.1mg, and 0.4mg Flumazenil administration. Psychomotor speed and memory function were assessed at T1 and T2. Twenty-five normal control subjects were also included for each experiment, and each participant also received the same battery of neuropsychological tests at phases approximately to T1 to T3, and T1 to T2 for experiments 1 and 2 respectively.

**Results:** Intrapersonal analysis revealed that Midazolam mainly affected psychomotor speed and memory functions. Flumazenil reversed impaired psychomotor and memory functions, particularly the former one, and the reversal effect was more remarkable with the high than low dose.

**Conclusions:** Based on our results, it appeared that Midazolam selectively induced cognitive deficits and Flumazenil dose-dependently reversed these deficits. Intrapersonal analysis procedure seemed more sensitive to detect drug-related cognitive changes than the group mean analysis one.

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#### J. MORGANO, J.B. HALE & J. RADCLIFFE. Neuropsychological Effects of Lead Poisoning on Behavior.

**Objective:** Lead poisoning has been recognized as having significant neuropsychological sequelae. Research on behavioral associates of lead exposure are now being investigated, especially for attention and aggression problems.

**Participants and Methods:** Multiple regression analyses were used to analyze cognitive, neuropsychological and behavioral data from a longitudinal, multi-site, cohort study containing 647 subjects representative of the demography of lead poisoning within the United States to determine whether a specific cluster of cognitive deficits could represent a 'signature' of lead exposure and whether the deficits found were associated with attention and externalizing behaviors. WISC III, NEPSY and BASC scores were compared to normative standardization population scores to determine level of impairment and to examine for performance differences patterns. Forced-entry multiple regression equations were used to determine which cognitive and/or neuropsychological subtests predicted behavior outcomes. Beta weights, zero-order correlations, semi-partial correlations and coefficients of determination were used to examine the nature and strength of the predictor-dependent variable relationships.

**Results:** Previous research conclusions that lead exposure reduces cognitive functioning and increases externalizing behaviors were supported. Performance on standardized measures was most predictive of difficulty with sustained and focused attention, attention problems, and hyperactivity.

**Conclusions:** Lead-exposed children were found to be more likely to experience executive-related attention problems in multiple environments. The Perceptual Organization Index was most predictive of externalizing behaviors, particularly aggression and conduct problems. Results suggest frontal-subcortical circuit and/or right hemisphere-white matter dysfunction subsequent to lead exposure. Session attendees will have a better understanding of the effect of lead exposure on cognitive development, executive functioning and behavior.

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#### S. SORG, M. TAYLOR, B. SCHWEINSBURG, O. ALHASSOON, A. GONGVATANA, R. THEILMANN & I. GRANT. Reduced White Matter Integrity in the Genu of Alcoholics and its Relationship to Processing Speed and Age.

**Objective:** Previous research found older alcoholics to be more susceptible than younger alcoholics to callosal white matter damage, however the neuropsychological consequences of this relationship remain unspecified. This study investigated differences in genu fractional anisotropy (FA), a diffusion tensor imaging (DTI) measure of white matter integrity, between recently detoxified alcoholics (RDAs) and controls, and explored the relationship between genu FA, age and processing speed. We hypothesized that RDAs would have lower FA than controls, processing speed would correlate with genu FA in alcoholics, and that this relationship would be moderated by age.

**Participants and Methods:** Participants included 45 recently detoxified alcoholics (mean duration of alcoholism=23.5 years) and 30 age-matched, non-alcoholic controls (mean age of sample=48.2). Processing speed was defined as the average demographically-corrected T-score on Digit Symbol and Trails A. DTI analysis used FSL's Tract-Based Spatial Statistics and targeted the genu. FA values for each participant were extracted from a cluster of voxels that significantly differed between the groups.

**Results:** The imaging analysis showed found that RDAs had lower FA than controls in the genu ( $p < .05$ ). Multiple regression predicting processing speed demonstrated a significant interaction between FA and age ( $F(3,39)=5.1, p < .001, R^2=.396$ ) such that, at low levels of FA, older RDAs had slower processing speed compared to younger RDAs. No significant relationship between FA and processing speed was found in controls.

**Conclusions:** The results support our hypothesis that alcohol abuse has negative impact on white matter fiber integrity in the genu. Further, such disruptions are particularly detrimental to processing speed of older alcoholics.

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#### L.M. SQUEGLIA, M.A. INFANTE, K.L. HANSON & S.F. TAPERT. Can Neuropsychological Assessment Predict Future Drinking in Adolescents?

**Objective:** While alcohol use may cause poorer neuropsychological (NP) functioning in adolescents, cognitive abilities may also influence the development and maintenance of alcohol involvement. This study investigated whether NP functioning in non-using adolescents could predict subsequent alcohol involvement, above and beyond the influence of family history of alcohol use disorder (FHA) and conduct disorder (CD).

**Participants and Methods:** At baseline, participants were 12-14 year-olds ( $n=83$ ) who endorsed minimal to no previous substance use. NP tests and interviews assessing substance use, family history, and conduct disorder were administered annually. Adolescents who transitioned into heavy ( $n=31$ ) or moderate ( $n=12$ ) alcohol use and non-using controls ( $n=40$ ) were evaluated. The mean follow-up period was 3.1 years (range: 1-5 years).

**Results:** Hierarchical regressions examined the influence of baseline attention, working memory, learning, and spatial and executive functioning on future alcohol involvement, controlling for age, FHA, and CD. Slower completion times on the Digit Vigilance Test predicted greater future monthly drinking [ $F(4, 79)=2.74, p < .05; R^2\Delta = .09; \beta = .31, p < .01$ ]. Worse baseline D-KEFS Color-Word Interference predicted greater subsequent hang-over severity [ $F(4, 74)=6.48, p < .001; R^2\Delta = .08; \beta = -.029, p < .01$ ]. In contrast, poorer Rey-Osterrieth Complex Figure copy performance predicted less future binge drinking [ $F(4, 77)=6.98, p < .001; R^2\Delta = .05; \beta = .25, p < .05$ ]. All results were significant above and beyond age, FHA, and CD.

**Conclusions:** Compromised attention and inhibitory functioning during early adolescence may predict future alcohol involvement. Contrary to hypotheses, better spatial functioning may be associated with a risk for subsequent binge drinking. Further investigation with a larger sample and longer follow-up will help clarify the prospective effects of baseline neurocognitive functioning on emergent drinking.

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**K. SULLIVAN, M. KRENGEL, C. COMTOIS & R.F. WHITE. Neuropsychological Functioning in Military Pesticide Applicators from Gulf War I.**

**Objective:** Gulf War veterans (GW) continue to report persistent cognitive and health symptom complaints many years following their deployment. Exposure to acetylcholinesterase (AChE) inhibiting pesticides and anti-nerve gas pills (PB) has been a suspected cause for these persistent complaints. The goal of this study was to evaluate the role of combinations of AChE inhibitors (pesticides and PB) on current cognitive functioning and health symptom status of GW veterans with known AChE exposures.

**Participants and Methods:** Participants included a unique group of 159 preventative medicine personnel (PM) including military pesticide applicators (high exposed) and PM personnel with very little pesticide exposure (low exposed). The groups were further categorized into high or low exposure to anti-nerve gas pills (PB), thus creating four exposure groups for comparison. It was hypothesized that the group with high pesticide and high PB exposure (group 4) would perform significantly worse on cognitive measures and report significantly more health complaints than GWI veterans with very little pesticide or PB exposure (group 1).

**Results:** Multiple regression analyses showed that group 4 performed significantly worse on CPT mean reaction times and reported increased mood complaints and health symptoms when compared with group 1. Significantly worse visual memory performance on the Rey-Osterrieth Complex Figure was found in group 2 (high pest, low PB) suggesting a different exposure vulnerability for this domain.

**Conclusions:** These findings support the hypothesis that exposure to multiple AChE inhibiting pesticides during their deployment contributed to the persistent cognitive and health symptom complaints in some Gulf War veterans.

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## Memory Functions

**J.W. ALBERTS. The Role Of A Dual Activation-Inhibition Process In Both False And Accurate Retrieval Of Information From Memory.**

**Objective:** Memory retrieval involves the activation of relevant information while inhibiting competing, irrelevant information. Since false memories can be viewed as impaired retrieval selection, children who demonstrate difficulty with cognitive inhibitory control in a selective-attention task may show a greater propensity to produce false memories. Three experiments were conducted to assess whether children designated as less efficient or more efficient inhibitors on the basis of Stroop interference, also produce higher rates of false memories.

**Participants and Methods:** 200 Children aged 8- and 10-years participated in this study.

Inhibitory control was measured as the degree of interference occurring on a Stroop task. Those demonstrating greater Stroop interference were assigned as less efficient inhibitors, those demonstrating less Stroop interference were assigned as more efficient inhibitors. The relationship between inhibitory control and observable behaviour was assessed using the Parent form of the Connor's Behaviour Rating Scale. False memories were measured by the number of falsely remembered critical lure words in a DRM memory task.

**Results:** ANOVA analysis indicated children designated as less efficient inhibitors produced significantly higher rates of false memories. No significant differences were found in regards to correct and incorrect recall. T-score analysis revealed a higher proportion of children assigned as less efficient inhibitors were rated as having difficulty relating to cognitive problems.

**Conclusions:** Results are discussed in terms of a dual process of activation/inhibition in relation to false memories. This study provides converging evidence supporting the role of a dual process of activation-inhibition in both false and accurate retrieval of information from memory.

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**J.W. ALBERTS. Does Age-related Susceptibility To False Memories Account For Developmental Differences In Rates Of False Memories?**

**Objective:** Contemporary researchers suggest children are more susceptible to false memories than adults. Therefore, the aim of this study was to examine the role of development in susceptibility to false memories. The hypotheses tested was whether age or cognitive processes such as inhibitory control, accounts for higher rates of false memories, and whether retrieval practice reduces rates of false memories.

**Participants and Methods:** 149 children aged 8 and 10 and 137 Adults participated in this study.

Children and Adults were designated as less or more efficient inhibitors on the basis of Stroop interference. False memories were assessed on the basis of the intrusion of critical lure-words on a DRM memory test. Immediately following the presentation of study lists, participants completed a retrieval practice task; completing word-fragments of study words.

**Results:** ANOVA analysis revealed regardless of age, individuals assigned as less efficient inhibitors produced significantly higher rates of false memories. Also, while retrieval practice significantly increased accurate recall, no significant decrease in false memories was observed.

**Conclusions:** These results provide further evidential support for the hypothesis that inhibitory control plays an important role in identifying individuals more susceptible to false memories from those that are less susceptible to false memories. Furthermore, age alone does not appear to account for increased susceptibility to false memories.

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**C.K. BLOCK & S.W. SAUTTER. Perception of Memory Complaints and Effort on Memory Performance.**

**Objective:** Examination of perception of memory complaints and effort on memory performance in a clinical sample.

**Participants and Methods:** There were 160 consecutive outpatients referred for memory complaints, with a mean age of 53 years (range 19 to 91 years), a mean of 14 years education (range 8 to 21 years), 51% female, and 77% Caucasian. Inclusion criteria required completion of the RBANS and Green's MCI and MSVT.

**Results:** No one best predictor of memory performance (percent retained on RBANS) emerged in a multiple regression of the MCI,  $F(9, 150) = .73, p = .685$ . Using a Chi Square analysis, a relationship was observed between perceived memory difficulties (MCI) and effort (MSVT) such that individuals with a high perception of memory difficulties had poor effort,  $\chi^2(1) = 6.11, p < .01$ . When perception of memory and effort were examined against RBANS percent retained, no main effect of perception on memory performance was found,  $F(1, 99) = .13, p = .72, \eta^2 = .001$ . A main effect was found for effort on memory performance,  $F(1, 99) = 17.96, p < .001, \eta^2 = .16$ . An interaction effect was observed between perception of memory and effort on memory performance,  $F(1, 99) = 4.93, p < .05, \eta^2 = .05$ . Individuals with high perception and poor effort had the lowest percent retained.

**Conclusions:** Effort, rather than perception, was found to influence subsequent memory performance. This finding may inform the differential diagnoses of memory complaints and subsequent selection of appropriate treatment strategies.

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**J.G. BRAND, W.B. BARR, C.E. MORRISON, L. NAKHUTINA & O. DEVINSKY. The Lateralizing Value of Rey-Osterrieth Complex Figure Test Item Eleven.**

**Objective:** The lateralizing value of the Rey-Osterrieth Complex Figure Test (RCFT) has been the subject of debate in the neuropsychology literature. While some studies have demonstrated some lateralizing capacity of the test qualitatively (Binder, 1982), specific scoring systems have had varied success (see McConley, Martin, Baños, Blanton, & Faught, 2006). Building on this literature, the current study assessed the ability of individual RCFT items to discriminate between patients with right and left temporal lobe epilepsy (RTLE and LTLE, respectively). Because “local” items are thought to be processed by the left hemisphere, they were hypothesized to discriminate between RTLE and LTLE groups.

**Participants and Methods:** Performance on the copy and delay phases of the RCFT by sixty patients with TLE (33 LTLE, 27 RTLE) was analyzed. Items were considered “forgotten” if they had been drawn during the copy phase but were absent during the delayed recall phase.

**Results:** Results showed that LTLE patients were significantly more likely than RTLE patients to forget item eleven (circle with three dots) after a delay, having drawn it during the copy phase ( $\chi^2 = 9.51, p < .009$ ). No other global or local items discriminated between the groups.

**Conclusions:** The results indicate that item eleven of the RCFT may provide a quick screening tool for discriminating between left and right hemisphere dysfunction in clinical settings.

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**E.M. BRICENO, S.L. WRIGHT, S.D. MOFFAT, D. MUCZYNSKI, M. SCHALLMO & S.A. LANGENECKER. The Relationship of Depression Symptoms to Spatial Navigation Performance Across the Lifespan.**

**Objective:** Evidence suggests that depression affects the structure and function of the hippocampal formation (HC) and is related to decrements in memory and executive functioning. Recent studies indicate that individuals with depression may exhibit decrements in performing spatial navigation tasks, which require memory and executive functioning and are supported by the HC. This study utilized a computerized human analogue of the Morris Water Maze task (MWM) to investigate the relationship of depression to allocentric (i.e., world-based) navigation across the lifespan.

**Participants and Methods:** Individuals with unipolar depression ( $n = 16$ , mean age 38.9 years) and controls ( $n = 31$ , mean age 40.3 years) completed the MWM. Participants used a joystick to locate a hidden platform over eight learning trials. Depression severity was measured using the 17-item Hamilton Depression Rating Scale (HDRS).

**Results:** A stepwise regression analysis was conducted, with joystick speed in the first step and HDRS and age in the second step as predictors of total distance traveled across trials. After accounting for speed, age and HDRS predicted 22.9 percent of the variance. Age contributed significantly ( $Beta = 0.402, p < 0.05$ ) to variance in navigation performance, but HDRS did not ( $Beta = 0.108, p = 0.43$ ).

**Conclusions:** Age is a stronger predictor of navigation ability than depression. These findings, however, are limited by the small sample size used herein. Data collection is ongoing, and acquisition of additional participants will further delineate the relative contributions of depression severity and age to navigation ability across the lifespan.

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**T. YANG & R.C. CHAN. The development of prospective memory in typically developing children.**

**Objective:** The current study aimed at designing prospective memory (PM) tasks that specifically capture different aspects of PM in typically developing children.

**Participants and Methods:** Two PM tasks, namely the Fishing Game and the Happy Week, were designed to examine the patterns of development in PM in these school-aged children. 120 healthy children between the age 7 and 12 (20, 10 girls and 10 boys in each age group) took part in this study. In addition to the PM tasks, retrospective memory (RM) and working memory (WM), attention and IQ tests were also administered to these children. Two preliminary tests validate the two PM tests.

**Results:** The findings showed that from 7 to 12, the age effect is significant and PM developed slowly in a continuous way. Among adjacent age groups, age 7-8 and 10-11 showed greatest increase. Age 7 tended to forget the PM tasks completely while Age 8 made repetition error more often than other age groups. The complex PM showed great increase between age group (9-10) and (11-12) but the difference disappeared when the cues are activated, which indicating that the cue is very important for the start of sets of PM tasks. The correlation between RM and PM, WM and PM are weak.

**Conclusions:** The current study provides preliminary findings on the validity of two new tests of prospective memory for children. It provides a general picture of the PM development in school-aged children and has some implications for educators and parents.

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**C.M. CONSIDINE, S.L. WRIGHT, L.A. BIELIAUSKAS, S. BERENT & S.A. LANGENECKER. Memory Task Performance and Dissimulation among Patients with Major Depressive Disorder.**

**Objective:** In legal settings, decreased memory performance in MDD has been explained as resulting from poor effort. Neurobiological studies of depression have challenged this hypothesis, suggesting that memory recall and effort are subserved by distinct processes and brain regions. We examined performance on the Test of Memory Malingering (TOMM) and visual and verbal memory tasks among individuals with MDD, relative to healthy controls.

**Participants and Methods:** Eighteen individuals with MDD ( $M\ age = 54.78$ ) and nine controls ( $M\ age = 43.67$ ) were administered the TOMM and CVLT-2. Controls and 10 MDD patients took the Michigan Spatial Relations Test (MSRT). Two separate repeated measures (rm) ANOVAs were conducted for the CVLT-2 and MSRT, with five learning trials and long (LDFR) and short (SDFR) delay recall trials, respectively, as within-subject variables, MDD status as the between-subjects variable, and age as a covariate. A similar rmANOVA was conducted for TOMM trials 1 and 2.

**Results:** MDD and control participants performed similarly on the TOMM ( $p = .71$ ), and all participants scored above the cut-off for determining potential poor effort. MDD and control participants performed similarly on the CVLT-2 and MSRT (all  $p > .40$ ). Age was a significant covariate across tasks (all  $p < .05$ ).

**Conclusions:** MDD participants performed similarly to controls on a measure of dissimulation and on tasks of learning and memory, though small sample size limits conclusions. We have previously demonstrated memory decrements on the CVLT-2 among patients with MDD. Data collection is ongoing, and reanalysis with a larger sample size will further elucidate the effect of effort on memory performance in MDD.

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**A. DEBASTOS & D. WABER. The Role of Semantic Clustering in Verbal Learning (CVLT-C) Is Age Dependent.**

**Objective:** We examined the relationship between semantic clustering during the learning trials and short and delayed recall performance on the CVLT-C in typically developing children and adolescents. Specifically, we hypothesized that the effect of clustering on task performance would be absent in the youngest children and would increase with age.

**Participants and Methods:** Three hundred and sixty-six children and adolescents (ages 5-16) who participated in the NIH MRI Study of Normal Brain Development completed the CVLT-C. For purposes of analysis, the sample was divided into three age groups: 5-8 years, 9-12 years, and 13-16 years. Within each group, multiple linear regression was applied (with Full Scale IQ and Gender as covariates) to evaluate the association between the semantic clustering variable and short and delayed recall.

**Results:** There was an effect of semantic clustering for the CVLT-C short ( $p < 0.01$ ) and long delay ( $p < .05$ ) free recall only in the adolescent group. In contrast, IQ predicted short delay free recall in the youngest ( $p < .001$ ) and middle ( $p < .05$ ) groups, but not in the adolescents. IQ predicted long-delay recall in all three age groups ( $p < .05 - p < .001$ ). IQ was not correlated with semantic clustering in any group.

**Conclusions:** Children do not appear to spontaneously use semantic clustering strategies to facilitate verbal learning until adolescence. IQ is the more prominent predictor at the younger ages. The semantic clustering variable on the CVLT-C may not be clinically relevant in younger children.

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#### **B.J. DIAMOND. Impact of Load, Operations and Fatigue on Processing Speed Using Novel Accuracy Selectable Programs.**

**Objective:** Examine the effects of memory load and number of operations performed on information processing speed and evaluate the relationship between processing speed and fatigue.

**Participants and Methods:** Thirty-five college-age adults ranging in age from 18 to 56 years of age ( $M = 24.6$  years,  $SD = 8.3$ ) gave informed consent.

**Results:** Accuracy which was set at 75% (using same-different responses) was comparable across tasks.

Tri-Task processing was slower ( $M = 3670$  ms,  $SD = 2145$ ) than Dual Task ( $M = 2535$ ,  $SD = 2445$ ),  $F(3, 57) = 13.8$ ,  $p = .000$ . Speed on a 0-Back Memory Search and Retrieval task using a three target load was slower ( $M = 460$  ms,  $SD = 582$ ) than 0-Back performance ( $M = 147$  ms,  $SD = 160$  ms) (Mann-Whitney U,  $z = -2.58$ ,  $p = .01$ ). Greater fatigue was correlated with slower processing on the 2-back, Non-Spatial ( $\rho = .37$ ,  $p = .05$ ), Spatial ( $\rho = .54$ ,  $p = .00$ ) and Dual tasks ( $\rho = .38$ ,  $p = .05$ ), but not with reaction time (RT).

**Conclusions:** Searching memory for three versus one item slowed processing speed by 300%. Adding one operation to the dual task slowed processing by 44%. Greater fatigue was associated with slower processing on the spatial, non-spatial and dual tasks but not RT. These findings help quantify differential processing burdens imposed by varying number of operations, memory load and spatial versus non-spatial processing, as well as provide insight into the impact of fatigue on processing speed.

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#### **P.S. FOSTER, V. DRAGO, S. PREJMACK, B. FERGUSON, R.M. RUFF, K.M. HEILMAN & D.W. HARRISON. Spreading Activation in Nonverbal Memory Networks.**

**Objective:** Collins and Loftus proposed a model of spreading activation stating that activation of a semantic node will spread along associative, bidirectional links to related concepts. We have previously used word frequency averages from performance on the Controlled Oral Word Association Test (COWAT) as an index of spreading activation to investigate this phenomenon. However, research has supported the existence of both verbal and nonverbal memory networks. Thus, we sought to investigate whether a spreading activation also exists in nonverbal mem-

ory networks. We constructed a corpus of design frequencies from performance on the Ruff Figural Fluency Test (RFFT) and calculated the average design frequency. We predicted that the average design frequency (an index of the extent of spreading activation in nonverbal memory networks) would be related to right posterior cerebral activity.

**Participants and Methods:** A total of 30 right-handed men completed the RFFT and the average design frequency was calculated for each individual. Correlations between the average design frequency and both alpha (8 to 13 Hz) and high beta (21 to 32 Hz) were then conducted.

**Results:** The results indicated significant negative correlations for both alpha and high beta at the right posterior electrode site. Additionally, negative correlations for high beta were found across numerous bilateral temporal and frontal lobe electrode sites.

**Conclusions:** These results potentially suggest that a similar process of spreading activation exists in nonverbal memory networks. Further research will need to be conducted using patient populations and also to determine whether a relationship exists between average word frequency (COWAT) and average design frequency (RFFT).

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#### **D.-. GOKCAY, A. KILIC & B. SAY. Emotional stimuli based exclusively on valence fail to enhance recognition memory: A study across ages.**

**Objective:** Research on recognition memory indicate enhancement for emotionally salient items. Most recently, it is suggested that young and old adults have different patterns of enhancement: increased recognition occurs for negative items for young, but for positive items for old adults. Unfortunately, in these studies, differential contributions of the emotional axes, valence and arousal, are not addressed. The aim of this study is to investigate the effect of valence in recognition memory by restricting the arousal level of the stimuli to neutral values while manipulating the valence level between positive, neutral and negative.

**Participants and Methods:** A mixed design with age between subjects and valence within subjects is used. Participants are 21 young (mean age 25.33) and 19 old (mean age 67.31) adult Turkish subjects. Stimuli are extracted from TUDADEN, an inventory of emotionally normed Turkish words. Study and test sessions are separated by an hour, each containing 60 and 120 words respectively. Valence categories of positive, negative and neutral are equally distributed among sessions, although presentation is randomized.

**Results:** When arousal is restricted to neutral values, recognition memory is not enhanced for emotional words varying along the valence dimension. Contrary to the literature, regardless of age, a decline in recognition memory is observed for positive items, whereas there is no change for negative items. Age differences showed no effect on hit rates, but had an effect on false alarm rates (more false alarms for older people).

**Conclusions:** We suggest that either the enhancement effect in recognition memory is more specifically a contribution of the arousal dimension, or emotional effects occur differently in Eastern and Western populations probably due to cultural differences.

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#### **S. ALI, S. LACEY, A.Y. STRINGER, K. SATHIAN & B.M. HAMPSTEAD. Assessment of 3-Dimensional Shape Recognition as a Novel Visuospatial Memory Test.**

**Objective:** Neuropsychological tests reliably assess verbal memory deficits following left temporal damage but inconsistently detect visuospatial deficits following right temporal damage. In an attempt to more sensitively measure visuospatial memory, a novel test was devised utilizing recognition of 3-dimensional shapes rather than traditional 2-dimensional drawings.

**Participants and Methods:** Thirty healthy controls (16 male; 24.8 years old ( $SD=10.5$ )) were given four learning trials to remember 12

towers, 6 of which were painted gray (GB) and intended to assess visuospatial memory, while the other 6 were multi-colored (CB) and intended to assess more verbal than visuospatial memory. Participants were instructed to encode stimuli by naming the colors (CB) or taking a mental picture (GB). A recognition memory test was given immediately after trials 1 and 4, and after a 20-minute delay. Participants were also administered the CVLT-II and Taylor Complex Figure (TCF).

**Results:** Overall, participants performed better for GB than CB after the first trial (significant block x time interaction). However, females performed substantially better on the GB than the CB whereas males performed similarly for both block types. No gender differences were evident on the CVLT-II or TCF. Correlational analyses suggest that participants used the same strategy throughout the CVLT-II and TCF but altered their strategy during the experimental test, which, anecdotally, became more verbally based.

**Conclusions:** Colors may have been distracting for participants, especially females, causing a shift in encoding strategy. Future work will examine the effects of unilateral temporal lobe lesions on block-type performance and of single-trial visuospatial learning tasks.

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**S. HAN, E.R. TUMINELLO, E.J. LUBOYESKI, J.M. WINGO & M.W. BONDI. Effects of Repetition and Encoding Strategy on Face-Name Recognition Memory.**

**Objective:** The ability to pair faces with names is arguably one of the most ecologically important memory activities. Previous studies have confirmed the facilitating role of repetition in memory; however, the effects of encoding strategies on face-name memory have received little attention. We sought to determine whether face-name recognition would (1) vary as a function of repetition, and (2) differ according to encoding strategy.

**Participants and Methods:** Seventy-nine young adult participants observed face-name pairs that were either new or repeated once, twice, or three times in random order. For half of the face-name pairs in random order, participants were asked to actively try and remember whether they have seen the same face-name pair before in the session ("yes/no" strategy). For the other half of the face-name pairs in random order, participants were asked to decide whether the name "fits" the face ("fit/unfit" strategy). Participants were then tested with a separate face-name recognition session that recorded rate of accuracy and confidence of responses.

**Results:** Within-participant analyses revealed significantly better recognition memory performances for the "fit/unfit" strategy trials versus the "yes/no" strategy trials overall ( $t=6.28, p<0.001$ ), for no repetitions ( $t=4.73, p<0.001$ ), one repetition, ( $t=4.07, p<0.001$ ), and two repetitions ( $t=2.39, p<0.001$ ), but not for three repetitions. The "fit/unfit" strategy also was associated with more "very confident" responses ( $t=3.08, p<0.001$ ) and fewer "not confident" responses ( $t=-2.74, p<0.001$ ) than the "old/new" strategy trials.

**Conclusions:** Deciding whether a name "fits" a face is supported by the present results as a potentially effective face-name encoding mnemonic. Future research is needed to elucidate what the underlying neurocognitive mechanisms of this strategy are and how they contribute to improved memory accuracy and confidence.

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**B.D. HILL, R.D. PELLA, J.R. O'JILE, D. GOUVIER, O.C. OKONKWO, H. WESTERVELT, J. DAVIS & G. TREMONT. Are Two Factors Better Than One? Examining the Validity of Combining Forward and Backward Digit Spans.**

**Objective:** Reynolds (1997) found that forward and backward span tasks formed two separate factors in a large sample of children and

adolescents. Based on these findings, combining forward and backward spans (as is commonly done on the Wechsler measures) was recommended against. This study sought to replicate these findings in a large sample with a more diverse age range than Reynolds' original study. We also wished to explore whether age had an impact on factor structure.

**Participants and Methods:** Records from 3199 individuals who had completed the WAIS-III Digit Span subtest as part of a broader outpatient neuropsychological evaluation were utilized. Participants age ranged from 6-90 years (mean 45.5, SD 23.9). Ethnicity: 89% Caucasian, 9% African-American, and 2% Latino. Exploratory factor analysis with principal axis factoring was used to determine the factor structure of forward and backward Digit Spans. This was done for the overall data and for five age subgroups: 6-17 years ( $n=223$ ), 18-30 years ( $n=1014$ ), 31-55 years ( $n=771$ ), 56-75 years ( $n=647$ ), and 76-96 years ( $n=537$ ).

**Results:** For the overall data, a single factor emerged that accounted for 65% of the variance in both forward and backward Digit Spans. A single factor also emerged for all of the following groups (variance accounted for by factor in parentheses): age 6-17 (73%), age 18-30 (60%), age 31-55 (66%), age 56-75 (65%), and age 76-96 (51%). Bartlett's test of sphericity was significant for all analyses.

**Conclusions:** We were unable to replicate Reynolds' (1997) finding that forward and backward span tasks load on distinct factors. While Reynolds recommended against combining forward and backward span tasks based on his findings, the current results support this commonly used test methodology. Additionally, our finding holds up both across and within a diverse age range, ruling out a developmental aspect to our divergent results. Additionally, the current results support Unsworth and Engle's (2006, 2007) recent conceptualization of working memory.

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**R.P. KESSELS, C. PIEKEMA, M. RIJPKEMA & G. FERNÁNDEZ. Hippocampal involvement in associative working memory: Evidence from fMRI.**

**Objective:** There is abundant evidence that the medial temporal lobe, including the hippocampus, is crucial for associative or relational memory. Consequently, hippocampal lesions may produce deficits in episodic memory formation which typically relies on intact associative processing or memory binding. However, recent fMRI data have indicated that the hippocampus may also be implicated in working memory binding, but most studies only focus on spatial binding. The present study systematically examines hippocampal activation in different forms of non-spatial working memory binding.

**Participants and Methods:** Nineteen participants performed a 3-pair Sternberg working memory task in the scanner (3T; 37 axial slices, TR = 2.18 s, TE = 25 ms), where associations had to be made between items processed within the same neocortical region (within-domain associations; house/house and face/face associations) and between items that are processed in different neocortical regions (between-domain associations; house/face associations).

**Results:** We demonstrate significantly more activation in the parahippocampal gyrus bilaterally (right:  $t[16]=4.59, p=0.011$ ; left:  $t[16]=3.78, p=0.028$ ) and the right hippocampus ( $t[16]=4.13, p=0.019$ ) when between-domain associations have to be made, compared to within-domain associations.

**Conclusions:** These results support the notion that both the hippocampus and parahippocampal gyrus are involved in the binding of nonspatial information processed in distinct neocortical regions using a working-memory paradigm. In line with recent evidence, our findings further challenge the dissociation of working memory and episodic memory and may also have implications for clinical neuropsychology.

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M.A. LANCASTER, M. SEIDENBERG, L. GUIDOTTI, A. ROSEN, K. DOUVILLE, K.A. NIELSON, J.L. WOODARD, S. DURGERIAN & S.M. RAO. **Attributes of Famous Face Recognition Speed.**

**Objective:** Face processing models identify a hierarchy of stages in which access to semantic information and naming occurs after perceptual recognition. Here, we examined the relationship of four stimulus attributes (amount of semantic knowledge, ability to produce the specific name, emotional valence, and emotional intensity) to the speed of famous face recognition.

**Participants and Methods:** 15 young adults ( $M_{age} = 20.2$ ,  $SD = 1.6$ ) completed a 30-item famous face recognition task. Following the recognition task, participants were asked to name the face and provide additional semantic information. Emotional valence and intensity were also rated. Bivariate and multiple regression analyses were conducted to determine the predictive value of the four stimulus attributes for face recognition reaction time (RT) collapsed across items. Only accurately recognized faces were included in the analyses.

**Results:** Significant ( $p < .05$ ) bivariate relationships were observed between RT and amount of semantic knowledge ( $r = -.49$ ), emotional intensity ( $r = -.42$ ), and ability to name ( $r = -.37$ ), but not for emotional valence ( $r = -.25$ ). More semantic knowledge, increased emotional intensity, and being able to provide a name were associated with faster face recognition RT. Moderate overlap among the three predictors made it difficult to assess their collective relationship with RT using multiple regression.

**Conclusions:** The influence of semantic attributes on speed of recognizing famous faces is consistent with a top-down processing approach to face recognition. Additional work is necessary to clarify the relationship of specific semantic attributes to face recognition speed.

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E. MENDOZA GONZÁLEZ & M. GONZÁLEZ RAMÍREZ. **The Prospective and Retrospective Memory Questionnaire (PRMQ): Psychometric Properties of Spanish Version.**

**Objective:** The Prospective and Retrospective Memory Questionnaire (PRMQ; Smith, Della Sala, Logie, & Maylor, 2000) has been useful to assess prospective and retrospective memory failures or slips in everyday life. It has been used in a variety of languages as German, Hindi and Swedish. Since there is not a Spanish adaptation yet; the purpose of this study was to translate it and to obtain information about its psychometric properties.

**Participants and Methods:** Back translation process was used to adapt PRMQ to Spanish language. A pilot application with a small sample was done before contact the volunteers for the study. The PRMQ was self-administered to 424 subjects, age between 18 and 83. PRMQ consists of sixteen items, eight asking about prospective memory failures and eight concerning retrospective failures. To analyze its properties Cronbach's alpha and confirmatory factor analysis were used.

**Results:** Central tendency measurements were mildly lower than the original study due to sample features. Internal consistency of the total scale and the Prospective and Retrospective scales were acceptable: 0.87, 0.83 and 0.72, respectively. Appropriate scale membership was indicated by item-total correlations for all items. Factor structure was compared with evidence from original study. Age and gender did not influence PRMQ scores ( $p > .05$ ).

**Conclusions:** This paper reports a preliminary analysis. We demonstrated adequate psychometric properties of the Spanish PRMQ version, and found it relevant due to the need of a short and accurate tool in our language that explores memory failures that can have a greater impact in daily living activities.

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E.H. MITCHELL, J. WOODWARD, J. CALAMARI, M. SEIDENBERG, S. ARORA, H. CHIK, M. DUX, M. MESSINA & N. PONTARELLI. **The Impact of Anxiety on Verbal Memory in Older Adults.**

**Objective:** Anxiety disorders are common among older adults, but little is known about the impact of anxiety on test-retest memory performance in older-adults. The purpose of this study was to examine the relationship of different aspects of anxiety (state, trait, vulnerability) on change in verbal memory performance over a six month test-retest interval.

**Participants and Methods:** 134 healthy, community dwelling older adults ( $M = 76.8$  years) were recruited to study risk factors for late-life anxiety. Six month test-retest performance on the Rey Auditory Verbal Learning Test (AVLT) and baseline negative affect ratings of depression and anxiety were collected. Multiple hierarchical regression analyses were conducted with time 2 AVLT indices serving as the dependent variables and baseline AVLT performance, demographic variables, and the negative affect measures entered as predictor variables.

**Results:** Higher self-report ratings of Anxiety Sensitivity (ASI) were associated with poorer test-retest AVLT performance after baseline memory, demographic and other negative affect variables were taken into account. This effect was strongest for females. The fear of mental dysfunction subcategory of the AS measure was the strongest predictor of memory performance. Depression was not a significant predictor of memory change over the test-retest interval.

**Conclusions:** AS, a trait-like measure of the "fear" of experiencing anxiety, was found to be a stronger predictor of six month test-retest memory performance in older subjects than measures of depression. This finding builds on previous results implicating effects of AS on subjective memory performance. Potential reasons for these findings and their implications are discussed.

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K. MORDECAI, E. EATOUGH, L. RUBIN & P. MAKI. **The Effects of Stress and Oral Contraceptive Use on Emotional Memory Retrieval in Young Women.**

**Objective:** Research studies demonstrate that sex hormones influence cognitive abilities. For example, research findings from our laboratory indicated a beneficial effect of oral contraceptives (OCs) on verbal memory (Mordecai, Rubin, & Maki, 2008). The mechanisms by which OCs may enhance memory are unknown, but a recent study by Kuhlmann and Wolf (2005) found that OC users do not experience the typical declines in verbal emotional memory retrieval that occur following cortisol administration. The observation that OC users show resilience to the negative effects of stress hormones on memory retrieval raises the possibility that OC use might improve verbal memory in part by lowering stress and anxiety. The goal of this study was to examine whether OC use protects against retrieval deficits following a psychosocial stressor, thereby providing a potential mechanism through which OCs may enhance memory.

**Participants and Methods:** Twenty OC users and 20 Nonusers completed a psychosocial stress paradigm (Trier Social Stress Test) and a non-stressful control task during Days 22-24 of their menstrual cycle. Immediately following each condition, participants were asked to recall positive, negative, and neutral word pairs learned 24 hours earlier. Salivary cortisol and subjective distress ratings were also measured.

**Results:** The stressor significantly increased cortisol and subjective distress. As predicted, psychosocial stress impaired retrieval of negatively valent words in young women. Contrary to predictions, OC use did not protect women from this impairment in retrieval after stress.

**Conclusions:** These findings support the hypothesis that the strength and accuracy of emotional memories can be weakened by stress at the time of recall.

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**E.E. MORGAN, S.P. WOODS, A. POQUETTE, O. VIGIL, R.K. HEATON & I. GRANT. Item and Associative Memory in Methamphetamine Dependence.**

**Objective:** Chronic use of methamphetamine (MA) has considerable effects on neuropsychological functions associated with frontal systems, particularly the strategic aspects of episodic memory. The current study examined the hypothesis that a disproportionately greater effect of lifetime MA dependence would be observed for associative versus item memory.

**Participants and Methods:** 114 MA-dependent (MA+) and 110 demographically-matched MA-nondependent comparison participants (MA-) completed a standardized neuropsychological battery that included the Brief Visuospatial Memory Test – Revised, which was scored for separate item (i.e., figure) and associative (i.e., location) memory indices.

**Results:** Significant main effects of MA were observed for item and associative memory ( $p < .05$ ), but the hypothesized interaction was not observed. In fact, the associative memory effect was no longer significant when corrected for item memory ( $p > .05$ ). Planned follow-up analyses on item memory revealed a profile of impaired immediate and delayed free recall ( $p < .05$ ) in the context of preserved recognition discriminability, with the former demonstrating significant associations with measures of executive functions, working memory, and length of abstinence from MA use ( $p < .05$ ). The findings were not better explained by common comorbidities (e.g., hepatitis C).

**Conclusions:** The MA+ group recalled fewer figures than the MA- group, but contrary to expectations there was not a disproportionate MA effect on associative memory. Recalled figures tended to be placed in the correct location, suggesting that the MA effect was primarily an item memory deficit, which was characterized by a mixed encoding/retrieval profile. Findings are commensurate with studies reporting deficient strategic verbal encoding and retrieval in MA users, which are posited to reflect the vulnerability of frontostriatal circuits to the neurotoxic effects of MA. Correspondence: *Erin E. Morgan, M.S., Psychology/Psychiatry, SDSU/UCSD Joint Doctoral Program in Clinical Psychology, 150 W. Washington Street, HNRC 2nd Floor, San Diego, CA 92116. E-mail: eemorgan@ucsd.edu*

**C. MRAKOTSKY, A. BOUSVAROS, S. BALLOU, G. SOELLING, D. WABER & R. GRAND. Corticosteroids, Immune Factors and Memory in Pediatric Chronic Illness: First Results on the Long-Term Effects of Steroids.**

**Objective:** Corticosteroids continue to be widely used in treatment of pediatric illness. Inflammatory proteins are released during active disease in a range of autoimmune and inflammatory conditions. Both have the potential to disrupt brain systems critical for memory and executive functions. Despite our earlier report of acute steroid effects on cognition, little is known about long-term effects and brain-immune interactions. Using pediatric Crohn's disease (CD) - a chronic remitting autoimmune illness- as disease model, we investigate longitudinally the effects of steroids and inflammation on memory and executive functions.

**Participants and Methods:** Children age 8-16 with CD ( $n=9$ ) on high-dose steroids ( $\geq 0.75$  mg/kg/day prednisone) were compared to an inflammation-free abdominal pain control group ( $n=9$ ) on measures of memory, executive functions, IQ, sleep, pain and behavior at baseline and 6 months post treatment.

**Results:** During active steroid treatment, the CD group showed poorer spatial learning ( $p=.02$ ) and word list recall ( $p < .01$ ), and reported more emotional control problems ( $p < .10$ ) than controls despite comparable IQ, sleep, pain, and demographics. Findings were dose de-

pendant. Higher levels of inflammation (ESR, CRP) during active disease were independently associated with poorer memory ( $p < .05-.10$ ), mood ( $p < .10$ ), social and adaptive skills ( $p < .05$ ). Post-treatment the CD group improved most notably in emotion regulatory functions ( $p < .05$ ), and demonstrated memory performance equal to controls.

**Conclusions:** We replicated earlier findings of acute steroid effects on memory and regulatory control, with evidence for improvement post-treatment. Inflammation contributes independently. Steroid safety and the role of the immune system in brain and cognition will be discussed. Correspondence: *Christine Mrakotsky, PhD, Psychiatry, Childrens Hospital Boston/Harvard Medical School, 300 Longwood Avenue, Pavilion 157, Boston, MA 02115. E-mail: christine.mrakotsky@childrens.harvard.edu*

**S.E. PANOS, A. OFEK, C. WALDON, L. MANCINI & R.S. KERN. Retention Deficits in Schizophrenia? Now You See Them...Now You Don't.**

**Objective:** Schizophrenia is characterized by generalized cognitive dysfunction with the deficits in memory perhaps most severely affected. Findings for retention have been mixed, perhaps due to differences in the way retention has been measured.

**Participants and Methods:** The present study compared a sample of schizophrenia outpatients ( $N = 41$ ) with age and sex matched healthy adults ( $N = 29$ ) on verbal measures of retention (i.e., holding information over time) using difference scores and savings scores. The memory measures (California Verbal Learning Test and Logical Memory subtest of the Wechsler Memory Scale-III) were administered as part of a larger memory battery. Testing was conducted in a single session and the order of test administration was counterbalanced across subjects to control for order effects.

**Results:** The results showed a group effect with patients impaired relative to healthy adults on Logical Memory, but not the CVLT, when a savings score was used ( $p < .05$ ). There were no significant findings between groups when difference scores were used for either the CVLT or Logical Memory.

**Conclusions:** Differences in the calculation of retention scores may account for some of the variability regarding impairments, or lack thereof, in this neurocognitive area of functioning.

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**D. PETRAC & J.S. BEDWELL. Self-Reported Lifetime Stress and Performance on Neuropsychological Tasks in Older Adults.**

**Objective:** Previous research has extensively examined the effect of acute stress on neuropsychological task performance, but has only infrequently correlated this performance with self-reported chronic stress over the lifetime. The current study explores this latter relationship in a sample of older adults.

**Participants and Methods:** Twenty-four older adults (50% male; mean age = 71.38, SD = 5.27; range = 63 to 84) completed the Perceived Stress Scale-10 (PSS-Month), a well-established self-report measure of stress experienced over the past month, as well as a customized version of this scale that asks about the entire life span (PSS-Life). Participants completed a short neuropsychological battery of memory and executive functioning.

**Results:** Results indicated that the PSS-Life was correlated to an increase in performance on the Wisconsin Card Sorting Test (Categories:  $r = .53, p = .009$ ; perseverative errors:  $r = -.61, p = .002$ ), as well as the Digit Span ( $r = .44, p = .02$ ), and Logical Memory II ( $r = .46, p = .02$ ) total raw scores from the Wechsler Memory Scales-III. The PSS-Month did not correlate with any of the neuropsychological measures.

**Conclusions:** Contrary to the hypothesis, self-reported lifetime stress in older adults was related to increased, rather than decreased, performance on tests of executive functioning and verbal memory. It may

WITHDRAWN

be that individuals with pre-existing higher levels of cognitive functioning were drawn to lifestyles and occupations that were associated with higher levels of ongoing stress. Further research is needed to better understand the potential bidirectional relationship between cognitive ability and lifetime chronic stress.

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**S. ALYA, K. BRYANT, A. MILLER, KAY, S. MAGNUSON, P. DINES & A.M. POREH. Analysis of Mean Learning of Normal Omani Young Adults on the Auditory-Verbal Learning Test.**

**Objective:** The study examined the universality of Poreh's (2005) linear logarithmic function  $R(t) = R1 + S \ln(t)$ , where R1 and S are functions of age, gender composition, mean education, and IQ.

**Participants and Methods:** A random sample of 172 young adults who reside in the Sultanate of Oman were tested. The average age was 25.46 (SD=6.2) and mean years of education was 10.48 (SD=2.19). The majority of the subjects were female (66%) and right handed (93.5%).

**Results:** The best-fit linear logarithmic equation to the mean recall data in each age group was examined using the trend function procedure of Excel. The  $r^2$  ranged from .087 to 0.99; there was a similar curve fit for subjects with low and high education. The curve fit across the whole sample without the age or education correction was  $r^2 = .99$ . As in Poreh (2005), trial 1 correlated significantly with age ( $r = .58$ ,  $p < 0.001$ ) and to a lesser degree with education ( $r = .26$ ,  $p < 0.01$ ).

**Conclusions:** The results of the present study support the universality of Poreh's formula for the AVLT. It suggests that a single formula can potentially be used across various cultures and ethnic groups to assess one's performance on this test. Additional studies using samples from other regions of the world are needed to support the above conclusion. Correspondence: *Amir M. Poreh, Ph.D., Psychology, Cleveland State University, 2121 Euclid Avenue, Cleveland, OH 44115. E-mail: aporeh@yahoo.com*

**P. RAMANATHAN, M. KENNEDY & C. MARSOLEK. Effects of Masked Lexical Priming on Metamemory Judgments in Brain Injury Survivors.**

**Objective:** Some researchers claim implicit memory affects metamemory (Rajaram, 1993; Reder & Schunn, 1996), while others claim it does not (Jameson, Narens, Goldfarb, & Nelson, 1990; Koriat, 1993; Kinoshita, 1997). Vernon and Usher (2003) suggest that implicit memory dominates rapid metamemory judgments and explicit processes dominate slow metamemory judgments. The present study varies masked priming conditions (baseline, prime, anti-prime) to examine whether implicit memory affects slow Judgments of Learning (JOLs) in adults with traumatic brain injury (TBI).

**Participants and Methods:** Seventeen TBI survivors and 12 matched controls have participated; an additional TBI survivor and six controls are scheduled. The study replicates Kennedy and Yorkston's (2000) paired associate learning task with JOLs, but modified to include subliminal masked priming of target tokens. Subliminal tokens are either a row of x-s (baseline), the ensuing target word (prime), or an unrelated word (antiprime). This is immediately followed by the cue-target word pair for 5s (controls) or 9s (TBI). Immediate and delayed JOLs are respectively made during and at the end of the learning block. Recall is tested two minutes after the delayed JOLs.

**Results:** Neither MANOVA nor ANOVA shows significant priming effects on slow Judgments of Learning. MANCOVA shows a between-groups interaction effect approaching significance, such that priming improves calibration of JOLs for the TBI population, relative to baseline and antiprime conditions.

**Conclusions:** The present study provides evidence that slow metamemory processes are not significantly influenced by implicit memory for individuals, but that priming may improve calibration of metamemory judgments in the brain injured population as a whole.

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**S. RANE, M. HISCOCK, N. LACHNER & M. PAPAIOANNOU. Are Verbal and Nonverbal Stimuli Registered in Separate Working Memory Systems? Analysis of Selective Interference and Serial Position Curves.**

**Objective:** The Baddeley and Hitch (1974) model of working memory posits separate short-term storage of verbal and nonverbal stimuli. On the other hand, other studies have yielded evidence that is consistent with a unitary mechanism on the bases of similar serial position curves (e.g., Jones, Farrand, Stuart & Morris, 1995). We addressed this debate in a series of two experiments that combined selective interference with the analysis of serial position curves.

**Participants and Methods:** Participants in each of the two experiments were 48 undergraduates (24 males and 24 females). Experiment 1 was a recognition study with two conditions: Participants were asked (1) to remember the order in which consonants were presented, and (2) to remember spatial locations of sequentially presented dots. Experiment 2 was identical except that it also examined the effects of verbal and nonverbal interference on memory for consonant order and dot location.

**Results:** Similarly shaped serial position curves were obtained for both verbal and nonverbal material in both experiments. Experiment 2 revealed a double dissociation in which nonverbal interference disrupted memory for spatial material to a greater extent than did verbal interference, and verbal interference disrupted memory for verbal material to a greater extent than did nonverbal interference.

**Conclusions:** Even though we found similar serial position curves for both types of material, an outcome consistent with a unitary system, the selective interference finding is at odds with the unitary model of memory. Quite possibly, the serial position curves are similar because they reflect the ability to place stimuli into the correct order rather than the ability to recall the identity of stimuli. It remains to be determined whether the unitary memory system hypothesis will be supported if serial position analyses are based on a more conventional memory task.

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**E.L. RISHER, S.A. ROGERS & D.A. LOWE. Depression and The Accuracy of Subjective Memory Complaints.**

**Objective:** Many recent studies have focused on memory decline in older adults. In light of research suggesting increased cognitive complaints in those with depressed mood, the present study examines the effects of depressed mood on the accuracy of subjective memory reporting.

**Participants and Methods:** 65 older adults completed the WSM-III subtests of Logical Memory and Visual Reproduction, the California Verbal Learning Test, 2nd edition (CVLT-II), and the Rey Osterreith Complex Figure. Z-scores for each subtest were averaged to form composite z-scores for verbal learning, verbal recall, total verbal memory, visual learning, visual recall, and total visual memory.

**Results:** Those with a subjective memory complaint performed significantly better on tests of verbal learning than those without a subjective memory complaint,  $t(62) = 2.12$ ,  $p < .05$ . Those with higher levels of depression had significantly lower scores in the domains of verbal learning, verbal recall, visual recall, and total verbal memory  $r(59-61) > -.26$ ,  $ps < .05$ . Depression was also higher among those with at least one subjective memory complaint relative to those with no subjective memory complaints,  $t(60) = -2.24$ ,  $p < .03$ . Covarying depression did not result in any significant differences in objective memory performance between those with and without a subjective memory complaint.

**Conclusions:** Older adults may only accurately report problems with verbal learning, but are otherwise inaccurate in their subjective perception of their memory concerns. It appears that depression is related to reduced performance on tests of verbal learning,

verbal recall, visual recall, and overall verbal memory. Those with a subjective memory complaint also appear more likely to experience higher levels of depression. Depression did not appear to affect the accuracy of memory reporting. These findings argue for the necessity of objective testing due to the inaccuracy of subjective memory complaints.

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**S. RUMBLE, T. BURNS & N. DEFILIPPIS. The Relationship of Processing Speed to Performance on the CVLT-C in a Pediatric Neurological Sample.**

**Objective:** The relationship between cognitive variables and CVLT-C (Delis, J.H. Kramer, E. Kaplan, & B.A. Ober, 1994) performance was investigated in a pediatric neurological sample. Studies in the past have demonstrated a relationship between processing speed and verbal learning in some pediatric samples (traumatic brain injury, psychiatric), and not in others (Acute Lymphoblastic Leukemia). The current study hypothesized that the Processing Speed Index would be more predictive of CVLT-C Total score than other WISC-IV factor indices in a broad neurological sample.

**Participants and Methods:** 118 children, ages 6-16, were included in the study. All children referred to the neuropsychology department at a southeastern children's hospital who completed a full WISC-IV and CVLT-C over a 1.5 year period were included. Multiple regression analysis was performed. Discriminant function analysis was used secondarily to determine the ability of the cognitive variables used in the study to predict diagnostic group membership.

**Results:** The combination of VCI and PSI predicted a significant amount of variance in CVLT-C Total Scores, as did the VCI alone ( $p < .01$ ;  $p < .00$ ). The PSI was a statistically significant predictor of group membership ( $p < .01$ ), with the strongest ability to predict membership in the epilepsy group.

**Conclusions:** High intercorrelations were present among the cognitive variables, almost to the point of redundancy between the VCI and PRI in the full sample. Thus, in a neurological sample, it is important to consider the relationship of these variables when interpreting pattern of performance.

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**J. STERN. Face-name association across life: do women always perform better?**

**Objective:** Associative memory for faces and names is a key process in daily life for social communication and adaptation. Previous studies (Valentine, 1991) have shown that this type of memory is a complex mechanism which requires the use of semantic information – such as occupation titles – for the association to be well integrated. It has also been demonstrated that this socio-cognitive function is sensitive to normal and pathological aging as it is based on cerebral structures particularly affected by neuronal degeneration. On the other hand gender differences have been little studied in this specific domain, although it is frequently shown that women outperform men in face recognition and verbal tasks.

**Participants and Methods:** The present study concerns a training paradigm associating 40 faces to names and jobs (visual or auditory presentation) during which subjects were asked to retrieve the correct associations as fast as possible. We studied performance variations depending on gender and age (20 to 30 and 65 to 80 years old).

**Results:** First we observed, that younger participants perform better than older participants, independently of the type of verbal information to be retrieved (name or job). In addition to this, the two age groups show the same facility for retrieving jobs as compared to names, as jobs present semantic and social weight. Finally, we found a gender difference advantaging women, that tends to get stronger with age.

**Conclusions:** These results will allow to explore, in future experiments, the differences between pathological (Alzheimer and pervasive developmental disorder) and control groups, within a remedial perspective.

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**J.J. TANNER, S.M. MITCHELL, S.D. TOWLER, D.M. MAHFOOD, C.C. PRICE & D.J. LIBON. Verbal List-learning and Memory in Dementia Patients: Understanding the Influence of Gray and White Matter.**

**Objective:** The roles that white matter and subcortical gray structures play in verbal list learning and memory are not well-understood. Specifically, white matter disruption identified as leukoaraiosis (LA) and various brain structures may differentially affect verbal list learning and memory performance.

**Participants and Methods:** 60 dementia patients were administered the Philadelphia (repeatable) Verbal Learning Test (PrVLT) and received neuroimaging. Ten indices of the PrVLT were used to create four factor-derived composite scores. MRI brain structure volumetrics were calculated. Total whole brain LA was also quantified as a volume. The four composite scores: 1) Delayed Free and Cued Recall, 2) Intrusions, 3) Immediate Memory, and 4) Recognition Memory were used as dependent variables in hierarchical linear regression analyses with whole brain and lateral ventricle volumes entered first to serve as control variables. Total LA volume was entered next with caudate volume entered last.

**Results:** For the recognition composite, only total LA volume significantly predicted performance ( $t=3.47$ ,  $p=.001$ ), with the overall model accounting for 18% of variance in recognition performance ( $F=4.15$ ,  $p=.01$ ). Adding in caudate volume did not improve the model. None of the hierarchical models using brain or brain structure volumes to predict recall, intrusions, or immediate memory were significant.

**Conclusions:** In dementia patients, verbal list learning and memory does not seem to be strongly influenced by whole brain, ventricle, or caudate volumes. However, larger volumes of LA are associated with better recognition scores, indicating a dysexecutive, rather than an amnesic list-learning profile.

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**D.E. TRAHAN & C.E. ROSS. Continuous Visual Memory Test: Performance in Patients with Clinical Depression.**

**Objective:** Studies have suggested that performance on memory tests that require effortful learning may be affected by clinical depression, a condition associated with a high base rate of memory complaints. This study examines performance on the Continuous Visual Memory Test (CVMT), a demanding measure of visual recognition memory using complex ambiguous designs, in patients with moderate to severe clinical depression.

**Participants and Methods:** Participants in the study were 21 adults (12 male, 9 female) ranging in age from 27-84 ( $M = 56.57$ ,  $SD = 15.19$ ). Average education was 12.62 years ( $SD = 2.75$ ). All were administered the CVMT, along with other neuropsychological measures. Participants had no history of head trauma or any other condition known to affect brain functioning. All were diagnosed with Major Depressive Disorder or Bipolar Disorder, Depressive Phase using DSM IV criteria. All had Beck Depression-II scores of 20 or higher and/or MMPI-2 raw scores of 32 or higher.

**Results:** CVMT Total and Delayed Scores were transformed into z-scores using age-appropriate means and standard deviations (Trahan & Larrabee, 1988, 1997). A t-test was then used to determine if group

scores differed significantly from a population with a hypothesized mean of zero. Results revealed nonsignificant differences for both the Total Score ( $t = -1.86, P > .05$ ) and Delay ( $t = -0.59, P > .20$ ). None of the 21 participants scored below established cutoffs for the Total Score, and only one scored below cutoffs for the Delay Score.

**Conclusions:** Results of the present study reveal that neurologically normal adults with moderate to severe clinical depression exhibit normal performance on the CVMT. Even though the CVMT is a demanding task requiring effortful learning, depressed patients were capable of handling task demands in a manner comparable to nondepressed adults. These results support the clinical utility of the CVMT in distinguishing between more subjective depression-related memory complaints and amnesic problems of a neurocognitive nature.

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#### **D.E. TRAHAN. Continuous Visual Memory Test: Performance in Patients with Anxiety Disorders.**

**Objective:** Several studies have suggested that performance on memory tests requiring sustained attention and effortful learning may be affected by clinical anxiety, a condition associated with a high base rate of memory complaints. This study examines performance on the Continuous Visual Memory Test (CVMT), a demanding measure of visual recognition memory, in patients with moderate to severe anxiety disorders.

**Participants and Methods:** Participants were 30 adults (12 male, 18 female) ranging in age from 24-76 ( $M = 54.31, SD = 14.10$ ). Mean education was 12.82 years ( $SD = 2.31$ ). All were administered the CVMT along with other neuropsychological measures. Participants had no history of head trauma or any other condition known to affect brain functioning. All were diagnosed with Generalized Anxiety Disorder, Panic Disorder, or Post Traumatic Stress Disorder using DSM-IV criteria. All had Beck Anxiety Inventory raw scores of 16 or higher and/or MMPI-2 K-corrected raw scores of 39 or higher.

**Results:** CVMT Total and Delayed Recall scores were converted to z-scores using age-based means and standard deviations (Trahan & Larrabee, 1988, 1997). A t-test was used to determine if group scores differed significantly from a population with a hypothesized mean of zero. Results revealed nonsignificant differences for both CVMT Total ( $t = -1.61, p > .10$ ) and Delay ( $t = -1.53, p > .10$ ). Only one of 30 participants scored below established cutoffs for the Total score, while two of 30 scored below cutoffs for the Delay score.

**Conclusions:** Results of the study reveal that neurologically normal adults with moderate to severe anxiety exhibit normal performance on the CVMT. Although the CVMT requires sustained attention and effortful learning, patients with anxiety were capable of handling task demands in a manner comparable to normal adults. Results support the utility of the CVMT in distinguishing between subjective anxiety-related memory complaints versus amnesic problems of a neurocognitive nature.

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#### **D.C. MUCZYNSKI, A.F. CAVENEY, S.L. WRIGHT & S.A. LANGE-NECKER. Relationship Between Five-Trial Verbal and Visuospatial Learning Tests in Healthy Participants.**

**Objective:** Verbal and visuospatial memory tasks are often compared, although direct comparisons are difficult due to differences in test design. We examined the relationship between the California Verbal Learning Test-II (CVLT-II) and the Michigan Spatial Learning Test (MSLT), both of which include five learning trials, distractor list, and short and 25 minute delays. We hypothesized moderate relationships between the two tasks, given that visual and verbal memory tasks have previously been shown to assess distinct memory processes.

**Participants and Methods:** Forty-five healthy participants ( $M$  age=38,  $M$  education=16 years, 41% Male) were administered the CVLT-II and the MSLT. Each MSLT learning trial consisted of 10 black circles drawn on a 7X5 grid, presented for 10 seconds. After removal, participants were asked to replicate the previous pattern on a blank grid. Both tests were administered in the standard CVLT-II format.

**Results:** Correlations on congruent trials of the tasks were moderate ( $.273$  to  $.536, p's < .074$ ), except for the first learning trial ( $r = .185$ ). A two (test) by five (learning trials) and a two (test) by two (free-recall trials) repeated measures ANOVA were conducted. Performance improved on subsequent learning trials, however, the increase from the 1st to 2nd learning trial was better on the verbal ( $p < .001$ ) measure. Retention of information was equivalent across tasks.

**Conclusions:** The similarities in testing procedures of these two tasks provide a unique opportunity to compare visuospatial and verbal aspects of learning and memory. These results support past studies finding discrete but interrelated verbal and visuospatial memory systems. Correspondence: *David C. Muczynski, Bachelor's of Science, Neuropsychology (Clinical), University of Michigan, 2124 Glencoe Hills Dr. Apt #1, Ann Arbor, MI 48108. E-mail: mudavid2@gmail.com*

#### **A. YAM, Y.M. SEARCY, K.J. HILL, M. GRICHANIK & U. BELLUGI. The Spatial Divide: Memory for Faces is a Relative Strength in Adults with Williams Syndrome.**

**Objective:** Williams syndrome (WS) is a neurodevelopmental disorder caused by a hemizygous microdeletion on chromosome 7q11.23. The WS visuospatial cognitive profile is characterized by a strength in face recognition skills, despite weaknesses in other visuospatial abilities. In addition, individuals with WS tend to display "hyper-social" behavior, the hallmark of which is a preference for and increased attention to human faces relative to other visual stimuli. To date, memory for faces relative to other visuospatial stimuli has not been fully explored in adults with WS. The present study compared adults with WS to an age- and Performance IQ- matched group of individuals with developmental disorders (DD) on two visuospatial memory tasks: faces and everyday scenes. It was hypothesized that relative to the DD group, the WS group would perform better on the memory for faces task.

**Participants and Methods:** Participants completed the immediate and delayed time conditions of two subtests (Faces and Family Pictures) of the Wechsler Memory Scale - 3rd Edition. Performance of the WS group ( $n=24$ ) was compared to that of the matched DD group ( $n=12$ ). Repeated measures ANOVAs compared the groups' performance on the two subtests, in both time conditions.

**Results:** Results revealed no significant differences between groups on immediate or delayed memory for Family Pictures, however the WS group performed significantly better on immediate and delayed memory for Faces ( $p < .05$ ).

**Conclusions:** Results suggest that memory for Faces in WS exceeds levels predicted by Performance IQ, and thus, the relative strength in face recognition exhibited by individuals with WS extends to memory for faces. Correspondence: *Anna Yam, Salk Institute, 10010 N. Torrey Pines Rd, La Jolla, CA 32601. E-mail: yam@salk.edu*

#### **L.B. ZAHODNE, A. NISENZON, C.E. PRICE, R.M. BAUER, H.H. FERNANDEZ, M.S. OKUN & D. BOWERS. Comparing Memory for Word Lists and Stories in Parkinson's Disease: Disease Effect or Psychometric Artifact?**

**Objective:** Clinically, patients with Parkinson's disease (PD) often perform more poorly on episodic memory tasks involving word-lists vs. stories (i.e., Hopkins vs. WMS-III Logical Memory). In this study, we tested two alternative explanations for this discrepancy. According to the fronto-striatal hypothesis, this difference may result from list-learning's greater requirements for effortful encoding and retrieval due to the absence of inherent organization and meaningfulness. Alternatively, the story-word list discrepancy may reflect normative sample differences between the Hopkins Verbal Learning Test (HVLT) and WMS-III for computing age-adjusted scores.

**Participants and Methods:** To examine these alternatives, we administered co-normed story and word-list learning tasks from the WMS-III along with the HVLTL to 37 patients with idiopathic PD during a two-day evaluation prior to deep brain stimulation surgery. Data from immediate and delayed conditions were analyzed using repeated measures ANOVA's and Bonferroni-adjusted follow-up comparisons.

**Results:** During immediate recall, performance was significantly worse on both word-list tasks, relative to stories ( $p < .001$ ). During delayed recall, this discrepancy only remained for HVLTL ( $p < .001$ ). Although age-adjusted delayed recall scores were lower on the HVLTL than WMS-III Word List ( $p < .001$ ), patients recalled more words on the HVLTL. No differences in percent retention occurred across the three tests.

**Conclusions:** Both hypotheses were partially supported in that patients exhibited immediate memory impairments for word lists compared to stories, but they performed better on WMS-III Word List than HVLTL after a delay. Further research is needed to determine to what extent the latter phenomenon is attributable to differences in normative data or task administration procedures.

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### Other

**D.A. GOLD, E. BARBUTO, G. ANTOVA, S. LOMBARDI, S. ROY & N.W. PARK. Memory for Perceptual and Functional Attributes of Novel Naturalistic Actions (NNAs) Under Full and Divided Attention Conditions.**

**Objective:** Following neurological damage such as stroke, individuals are frequently impaired in their performance of naturalistic actions (NAs; e.g., preparing a sandwich), and their ability to acquire unfamiliar, multi-step, goal-directed actions involving tools used atypically (NNAs; e.g., building a mock volcano). The purpose of this experiment was to examine memory for NNAs under full and divided attention conditions. Previous research with simple objects and actions indicates that when cognitive resources are scarce, individuals tend to focus on the intention of the actor, rather than the observed action itself (e.g., Bekkering et al., 2005).

**Participants and Methods:** Under full and divided attention conditions (verbal lag 1 secondary task), undergraduates ( $n = 30$ ) were shown 90 second videos of actors constructing NNAs and were led to believe that they would enact the NNA after viewing it. Instead, memory was assessed using a forced-choice recognition test that examined functional (what was the tool in the video used for?) and perceptual aspects (what was the color of an object in the video?) of the NNA.

**Results:** Functional and perceptual information was recognized equally well under full attention. In contrast, under divided attention conditions, there was a greater decline in memory for perceptual information compared to functional information.

**Conclusions:** These findings suggest that when cognitive resources are scarce, there is a priority for encoding the intentions of actors when viewing the construction of an NNA. Implications of these findings for understanding the cognitive processes underlying the memory representation of NNAs and impairments in stroke patients in acquiring NNAs will be discussed.

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**G.L. IVERSON, B.L. BROOKS, K.E. FERGUSON, M. ROBERGE & A.H. YOUNG. Cognitive Impairment in Children, Adolescents, and Adults with Mood Disorders: Does a Subgroup Drive the Effect?**

**Objective:** We hypothesized that (a) a minority of patients with mood disorders have measurable cognitive impairment, (b) this minority is driving the effect sizes detected in group studies, and (c) if you remove this minority from the group statistical analyses, the significant effect sizes will virtually disappear.

**Participants and Methods:** Three clinical samples included: (a) 30 children and adolescents with depression (Age=14.4 years, SD=2.1, Range=9-17), (b) 100 medication-free adult outpatients with depression (Age=39.1 years, SD=12.5; education=14.8 years, SD=2.4), and (c) 47 adult outpatients with bipolar disorder (Age=38.2 years, SD=11.0; education=15.2 years, SD=2.3). Each clinical sample was carefully matched, in a case-control fashion, to an equal number of healthy subjects (based on sex, age, education, and ethnicity). All examinees completed CNS Vital Signs, a 30-minute computerized neurocognitive test battery.

**Results:** Medium-large effect size differences in neurocognitive test performance were observed for children with depression (Memory  $d = .43$  and Complex Attention  $d = .58$ ), adults with depression (Memory  $d = .64$ , Processing Speed  $d = .59$ , Reaction Time  $d = .37$ , Cognitive Flexibility  $d = .54$ , and Complex Attention  $d = .72$ ), and adults with bipolar disorder (Memory  $d = .53$ , Processing Speed  $d = .73$ , Reaction Time  $d = .71$ , Cognitive Flexibility  $d = .71$ , and Complex Attention  $d = .95$ ). Using two or more index scores below the 5th percentile as the cutoff for neurocognitive impairment, a substantial minority of each clinical sample was impaired (i.e., 30-43%). When the impaired patients are removed from the analyses, the remaining patients cannot be differentiated from controls.

**Conclusions:** Cognitive impairment associated with mood disorders was limited to a minority of patients; the majority were cognitively normal. The effect sizes reported in the literature seriously underestimate the adverse effects of mood disorders on cognition. They are diluted by the majority of patients who have no measurable cognitive impairment.

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**N. CROCKER, A.E. WAGNER, L. VAURIO & S.N. MATTSON. Children with Heavy Prenatal Alcohol Exposure Show "What" and "Where" Visuospatial Deficits.**

**Objective:** Heavy prenatal alcohol exposure alters the development of both temporal and parietal regions, however, the parietal lobe is relatively more affected. Visuospatial function is under studied in this population and no studies have examined "what" vs. "where" processing. The current study tested the hypothesis that children with heavy prenatal alcohol exposure demonstrate greater impairment on where than what visuospatial measures.

**Participants and Methods:** Children with heavy prenatal alcohol exposure (ALC,  $N = 31$ ) and nonexposed controls (CON,  $N = 33$ ) were evaluated using eight computerized and traditional (pencil and paper) visuospatial measures. Groups were matched on age, socioeconomic status (SES), sex, race, ethnicity, and handedness. Computerized and traditional measures were analyzed separately using 2 x 2 repeated measure ANCOVA with group as the between-subjects measure, and type of processing (what vs. where) as the repeated measure. Age and SES were included as covariates when appropriate.

**Results:** For both computerized and traditional tests, the main effect of group was significant but the group x type interaction was not. The ALC group performed more poorly than the CON group on both what and where measures.

**Conclusions:** Despite previous reports of greater parietal vs. temporal involvement, children with heavy prenatal alcohol exposure had uniform impairment on measures of what and where visuospatial ability. These deficits may contribute to observed impairments in more complex domains such as nonverbal memory and spatial navigation. Additional study is needed to determine if similar deficits occur across other aspects of visuospatial function.

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M.T. WAGNER, A. SOPER, A.L. MCRAE-CLARK, M.L. SALADIN, B.K. TOLLIVER, K.L. PRICE & K. BRADY. **Cognitive Functioning Among Recently Abstinent and Current Methamphetamine (MA) Users.**

**Objective:** Research concerning relations between MA use and cognitive functioning has yielded inconsistent results. The aim of this study was to describe cognitive functioning in a sample of chronic MA users as a part of a larger center grant.

**Participants and Methods:** Data are from a NIH Translational Research in Addiction Center (TRAC) study on the clinical neurobiology of methamphetamine dependence. We report on thirty adults characterized as abstinent from MA ( $N = 19$ ) or non-abstinent during the past 30 days ( $N = 11$ ). Measures included the TOMM, Shipley, WCST, PASAT, CVLT-II, subjective cognitive impairment ratings (MSNQ; Benedict et al., 2003), and the BDI-II.

**Results:** Data analysis showed a number of cognitive complaints that were unsubstantiated by objective data. There were no significant departures from expected cognitive performance across multiple measures. Neither abstinence nor depressive symptomatology was significantly correlated with performance on tests of cognitive functioning. Although only one individual met DSM-IV criteria for major depressive disorder, participants' mean scores in this sample ( $M = 14.3$ ;  $SD = 11.7$ ) indicate mild to moderate depression. Overall BDI-II scores were significantly correlated with subjective cognitive MSNQ scores ( $r = .67$ ;  $p < .001$ ), such that greater depressive symptomatology was significantly, positively associated with greater cognitive complaints.

**Conclusions:** Participants in this sample of current and former MA users endorsed a number of subjective cognitive complaints without evidence of objective cognitive impairment. A greater number of complaints were associated with increased depressive symptomatology. Limitations included sample size, lack of a control group and limited data on abuse history.

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## Psychopathology/Neuropsychiatry (Other)

E. AVERY, S. WRIGHT, M. RANSOM & S. LANGENECKER. **Attention and Inhibitory Control during Late Life Depression.**

**Objective:** This study uses the Parametric Go/No-go Task (PGNG), a computerized measure of attention and inhibitory control, to investigate the relationship of depression and age to executive functioning. Our group has previously demonstrated decrements in inhibitory control, but not attention among young outpatients with Major Depressive Disorder (MDD) using the PGNG. Given that late life depression has been associated with executive dysfunction, we hypothesized that older adults with MDD would exhibit decrements in sustained attention and inhibitory control, relative to young and elder healthy controls and young patients with MDD.

**Participants and Methods:** Fourteen young ( $M$  age=32.71) and 8 elder individuals ( $M$  age=63.33) with MDD and 28 young ( $M$  age=30.39) and nine elder ( $M$  age=60.44) control participants were administered the PGNG. The task is divided into three levels: a three-target go level, a two-target go/no-go level, and a three-target, go/no-go level.

**Results:** Percent correct target trials (PCTT) and percent correct inhibitory trials (PCIT), respectively, were entered as the dependent variables in two separate 2 (MDD status) \* 2 (age) repeated measures ANOVAs, with level of the PGNG as the within subject variable. For PCIT, elder controls performed worse than the three other groups on the easy ( $ps < .01$ ), but not the difficult ( $ps > .05$ ) level. For PCTT, elder MDD participants performed more poorly than the other three groups for levels one and two ( $ps < .05$ ) and worse than young controls for level three ( $p = .03$ ).

**Conclusions:** Late life depression results in decrements in sustained attention and inhibitory control, supporting research characterizing late life depression as a dysexecutive syndrome.

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J. BENGE, R. COLLINS & T. KENT. **A Pilot Study of Executive Functions in PTSD.**

**Objective:** Post-Traumatic Stress Disorder (PTSD) is characterized by emotional and cognitive complaints. Researchers have recently begun exploring the relationship between the core symptom clusters of PTSD and possible cognitive mechanisms underlying them. In particular, executive functions and general intellectual functioning have been implicated in the development and maintenance of PTSD symptoms. This study sought to evaluate the relationship of executive functioning with PTSD symptoms in clinical population.

**Participants and Methods:** 23 mostly Vietnam war era veterans who were receiving treatment for PTSD completed a PTSD symptom checklist and a battery of language and select executive measures drawn from the Dellis Kaplan Executive Function System.

**Results:** Overall, the patient's executive functions were within normal limits. Significant negative correlations were observed between all PTSD symptom clusters and abstraction abilities, speeded motor skills, and speeded attention. An estimate of premorbid IQ was strongly related to re-experiencing symptoms. Semantic fluency, but not phonemic fluency was negatively associated with symptoms of avoidance and hyperarousal.

**Conclusions:** While executive functioning in this PTSD sample was within normal limits, there was evidence that different executive functions may be differentially related with PTSD symptom clusters. The relationships of these findings to broader neuropsychological and neuroanatomical conceptualizations of PTSD are discussed.

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R.K. BHALLA, M.A. BUTTERS, R.C. MANTELLA, C.F. REYNOLDS & E.J. LENZE. **Neuropsychological Functioning in Late-life Generalized Anxiety Disorder.**

**Objective:** Despite high rates of prevalence, very few studies have examined cognitive functioning in late-life generalized anxiety disorder (GAD). The purpose of this study was to characterize neuropsychological functioning in late-life GAD. Due to the chronic nature of GAD and associated Hypothalamic-pituitary-adrenal (HPA) axis dysfunction, we predicted that late-life GAD subjects would be more impaired on measures of memory, attention and executive functioning than comparison subjects.

**Participants and Methods:** We examined neuropsychological functioning in 40 non-demented subjects age 60 years and older meeting DSM-IV criteria for GAD and 25 age- and education-equated comparison subjects.

**Results:** Relative to comparison subjects, late-life GAD subjects performed poorer on measures of delayed memory ( $t = 2.04$ ,  $df = 63$ ,  $p < 0.05$ ), working memory ( $t = 1.85$ ,  $df = 63$ ,  $p = 0.06$ ), and visuospatial functioning ( $t = 2.51$ ,  $df = 63$ ,  $p < 0.01$ ).

**Conclusions:** Late-life GAD is associated with cognitive impairment in several domains. Although not well elucidated to date, cognitive impairment in late-life GAD may be related to elevated cortisol levels and HPA-axis dysfunction associated with the chronic nature of the disorder.

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S.P. CERCY. **Gray Matter Heterotopia Associated with Mild Cognitive Dysfunction.**

**Objective:** Gray matter heterotopia (GMH) is a developmental disorder of cortical neuronal migration associated with a high risk of childhood-onset epilepsy and significant cognitive disorder. Males tend to

have focal, posterior-predominant GMH and a bi-modal distribution of cognitive dysfunction; females tend to have diffuse, frontal-predominant GMH and mild to moderate cognitive disturbance. Patients with schizophrenia may have an increased prevalence of GMH. Clinical features are described in a adult with multifocal GMH.

**Participants and Methods:** A 46 year-old man was admitted after reporting homicidal-suicide ideation. Head trauma with LOC occurred at age 32 and 38. Generalized seizures with left temporal focus began following the latter TBI. He had a history of bipolar affective disorder (BAD), cocaine abuse, and binge alcohol abuse. MRI showed nodular subependymal heterotopia at the right posterior horn, band heterotopia in the right occipital subcortical region, and right parietal-occipital pachygyria. He underwent neuropsychological evaluation during admission.

**Results:** Visuospatial organization and recall memory for visual material were severely impaired. Verbal recall memory, confrontation naming, processing speed, abstraction, and complex working memory were deficient.

**Conclusions:** The clinical presentation was consistent with prior reports of GMH in males. The deficit profile suggested right posterior GMH was a significant factor contributing to cognitive dysfunction. However, seizure disorder began in middle adulthood, apparently in association with TBI, rather than the typical spontaneous childhood onset. Moreover, BAD may represent further evidence of clinical heterogeneity in the psychiatric presentation of GMH. In addition to TBI, confounding variables included seizure disorder, alcohol abuse, and effects of anticonvulsant medication. Correspondence: *Steven P. Cery, Ph.D., Psychology Division, New York Veterans Affairs Medical Center, Room 2656, 423 E 23rd Street, New York, NY 10010. E-mail: steven.cery@va.gov*

#### S.P. CERCY & J. MARASIA. Delusional Misidentification in a Patient with Parkinson Disease.

**Objective:** Delusional misidentification syndromes (DMS) are an infrequent manifestation of Parkinson disease (PD), and when present, have been attributed to underlying dementia. We describe cognition and associated findings in a patient with PD and DMS.

**Participants and Methods:** A 68 year-old man with advanced PD and visual hallucinations (VH) began claiming that his wife was replaced by an identical imposter. Occasionally he misidentifies his wife as one of his daughters. Similarly, he sometimes reports that a stranger appears to be a duplicate of his wife. Seroquel was started for VH, with improvement; DMS were unchanged. He is also treated for hyperlipidemia, diabetes, hypothyroidism, and skin cancer. Blunt head trauma occurred in 2005 without loss of consciousness. There was no history of alcohol abuse, substance abuse, or prior psychiatric history. He underwent neuropsychological evaluation.

**Results:** Severe impairments were elicited in visuospatial processing, semantic fluency, abstraction, concept formation, speed of visual search, and cognitive flexibility. Mild impairments were found in confrontation naming and olfaction. Visual recall memory, verbal learning, and phonemic fluency were deficient. Retention and recognition memory for verbal material and attention were intact.

**Conclusions:** DMS in this case consisted of combined Capgras, Fregoli, and intermetamorphosis syndromes preceded by VH. Prominent dysexecutive syndrome and mild memory deficit support the notion that cognitive dysfunction predisposes PD patients to DMS, but frank dementia is not a necessary condition. Non-responsiveness of DMS to atypical neuroleptic in some patients with PD suggests VH and DMS may be 1) at least partially dissociable, and 2) attributable to distinct pathophysiological mechanisms. Correspondence: *Steven P. Cery, Ph.D., Psychology Division, New York Veterans Affairs Medical Center, Room 2656, 423 E 23rd Street, New York, NY 10010. E-mail: steven.cery@va.gov*

#### W. LIU, R.C. CHAN, L. WANG & A.J. HUANG. Stress reduces reward responsiveness in individuals with elevated depressive symptoms.

**Objective:** The current study attempted to examine whether individuals with depressive symptoms might impair reward responsiveness as compared to those without depressive symptoms.

**Participants and Methods:** Forty-two healthy volunteers took part in the study. They were divided into non-depressed and depressed subgroups (twenty-one individuals in each group) with a cut-off of 16 of the Beck Depression Inventory A signal detection paradigm was adopted. Perceived stress was induced by a negative feedback shown during the task performance. Questionnaires captured emotion expressions were also administered to all participants after the completion of the task.

**Results:** For participants with depressive symptoms, the response bias of the stress condition was decreased significantly while the response bias of the no-stress condition was not significant. For the control subjects, the response bias of the no-stress condition was decreased significantly while the response bias was not significant in the stress condition. No significant effects emerged for the response bias of two groups under both stress and no-stress conditions.

**Conclusions:** Elevated levels of depressive symptoms, particularly anhedonic, were associated with impaired reward responsiveness during the stressful condition. In particular, reduced hedonic capacity appears to be associated with increased anxiety under stress condition and linked to self-report measures of anticipatory pleasure.

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#### F. DEGHANI ARANI & R. ROSTAMI. Effectiveness of Neurofeedback Treatment on Psychological Health, Craving and Abnormal Brain Activities in opiate dependent patients.

**Symposium Description:** To examining effectiveness of neurofeedback treatment on general mental health, craving indexes and abnormalities in brain activities in opiate dependant patients, twenty volunteers undergoing an medicine treatment, were selected in a lumpy way and assigned in two matched groups. In this experimental study with pre-post test design, experimental group received 30 sessions neurofeedback treatment further usual medicine treatment. Neurofeedback included fMRI training on Cz, followed by an alpha-theta protocol on Pz. Control group just received usual medicine. Data were gathered by examining all subjects with General Health Questionary (GHQ-28), Heroin Craving Questionary (HCQ), and Quantitative Electro Encephalo Gram (QEEG) before and after treatment term. Multivariate analysis of covariance (MANCOVA) showed that experimental group had an significant difference in somatic symptoms, depression symptoms, and total score in general psychological health, also in anticipation of positive outcome and relief from withdrawal or dysphoria, desire to use substance, and total average score of craving, and finally in Delta (frontal, central and parietal), Theta (frontal and central), Alpha (parietal), SMR (frontal and central) brain waves, in comparison with control group. Therefore neurofeedback training can be used to improve the effectiveness of neuropsychological treatment results in opiate dependant patients.

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#### M. DICKINSON, S. BASER & C. SCHRAMKE. Effects of Dopamine Agonist Therapy in Patients With Parkinson's Disease.

**Objective:** Impulse control disorders (ICDs) including excessive sexuality, gambling, and compulsive shopping have been reported with the use of dopaminergic medication in Parkinson's disease (PD) patients. This study compared the prevalence and pattern of ICD behaviors in PD patients taking the dopamine agonists pramipexole and/or ropinirole versus patients not taking these medications.

**Participants and Methods:** One thousand patients diagnosed with PD and treated at a PD clinic were mailed surveys to be completed anonymously. These surveys assessed demographic characteristics, length of disease, current symptoms/medications, and ICD behaviors. Four hundred and thirty surveys were returned. Chi-square analyses compared the frequency of ICD behaviors in patients taking no dopamine agonists (199 patients) versus those taking pramipexole (120 patients), ropinirole (96 patients), or both (8 patients).



**Results:** A clear pattern emerged in patients taking dopamine agonists compared with those who did not. A significantly higher frequency of increased interest in sex ( $p = .016$ ), playing the lottery ( $p = .01$ ) and video poker ( $p < .001$ ) was reported in patients taking pramipexole. A significantly higher frequency of hallucinations and interest in shopping was reported in patients taking ropinirole ( $p < .005$ ). A higher frequency of decreased sleep was associated with both medications ( $p = .001$ ) compared to patients taking no dopamine agonists.

**Conclusions:** Prior studies have examined the types and prevalence of ICD behaviors in PD patients treated with dopamine agonist medications. This study not only replicates prior findings regarding the effects of pramipexole and ropinirole, but also offers interesting distinguishing characteristics associated with each medication.

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**M. GORLYN, J.G. KEILP, M.E. RUSSELL, M.F. GRUNEBaum, A.K. BURKE & J.J. MANN. Antidepressant Medication Effects on Cognitive Functioning and Subjective Mood Mediate Suicidality in MDD.**

**Objective:** Depressive symptom relief alone may not be sufficient to lower suicidal ideation and behavior in patients with Major Depressive Disorder (MDD). Attempter-specific cognitive deficits contribute independently to suicide risk, and information about the trajectories of cognitive functioning and suicidality during antidepressant treatment is limited. We conducted a preliminary analysis of repeated mood and neuropsychological assessments in an ongoing treatment study with high suicide-risk MDD patients separated into drug treatment groups (medication still blinded).

**Participants and Methods:** Patients ( $N=36$ ) met DSM-IV criteria for MDD with histories of suicide attempt and/or current ideation. Mood (HDRS, BDI, POMS), suicidal ideation, neuropsychological functioning and subjective cognitive performance (Cognitive Failures Questionnaire; CFQ) were evaluated before and after 2-months double-blinded treatment with paroxetine or bupropion.

**Results:** Both medications lowered HDRS and BDI scores equally. However, one medication produced greater reductions in suicidal ideation, significant decline in mood disturbance (assessed with POMS broad self-report mood scale), and significant decrease in patient-report cognitive problems. Change in CFQ scores was associated with changes in suicidal ideation and neuropsychological memory measures.

**Conclusions:** Medications with equivalent antidepressant properties appear to have differential effects in treating suicidality particularly via their influence on subjective mood and cognition. Aspects of mood such as anger and confusion, not prominent in depression scales, may best distinguish patients with sustained suicide risk. Neuropsychological changes during treatment suggest reduced suicidal ideation may result from a medication's ability to enhance cognitive functioning.

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**C.B. HARTE, M. LOPEZ & R.C. HAWKINS. Depressive Symptomatology and Neurocognitive Performance.**

**Objective:** Depressed individuals commonly demonstrate a discrepancy between verbal and nonverbal abilities on both the WAIS-R and WAIS-III. The purpose of the current study was to determine if the magnitude of current depressive symptomatology (irrespective of MDD diagnosis) was characterized by a specific neuropsychological profile in a sample of patients with a variety of comorbid psychiatric diagnoses.

**Participants and Methods:** WAIS-III IQ scores and individual subscale scores were compared between 82 patients with depressive symptomatology ( $BDI > 13$ ) and 56 patients without depressive symptoms.

**Results:** After controlling for number of Axis I diagnoses, depressed patients had significantly lower Full Scale IQ (FSIQ) and Verbal IQ (VIQ).

Neither Performance IQ (PIQ), nor the absolute VIQ/PIQ difference differed significantly between groups. With respect to WAIS-III subtests, vocabulary, comprehension, and notably arithmetic, differed between groups, with depressed patients scoring significantly lower on these tests. When the BDI cutoff for clinically significant depressive symptomatology was raised to 20 (characterizing 40 and 98 depressed and nondepressed patients, respectively), only the arithmetic subtest distinguished between groups, with depressed patients scoring significantly lower than nondepressed patients. In all analyses, age, years of education, gender, and number of Axis II diagnoses did not moderate group differences.

**Conclusions:** In conclusion, results did not support prior studies suggesting impaired PIQ, but rather revealed that intellectual performance in patients with clinically significant depressive symptoms is best characterized by global verbal abilities and particularly poor arithmetic performance. Inclusion of patients with psychiatric comorbidity has important clinical and theoretical implications, and will be further discussed.

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**K.M. ISAACS, M.D. JOHNSON, E. KAO & D.L. GILBERT. Precipitating Events and Significant Life Stressors of Pediatric Patients Diagnosed with a Psychogenic Movement Disorder.**

**Objective:** The occurrence of psychogenic movement disorders (PMD), which present with abnormal movements and symptoms that are inconsistent with known neurological diseases, is well documented in adult populations. Few data exist on this disorder in a pediatric population. The purpose of this study was to analyze the phenomenology and understand the prevalence and common characteristics of precipitating life events and major life stressors of children and adolescents diagnosed with a PMD.

**Participants and Methods:** A retrospective chart review of electronic records from 2003 to 2007 was completed to identify patients with a PMD who attended a children's hospital Movement Disorders Clinic. The phenomenology was assessed by a movement disorders specialist using standardized criteria. The demographics, phenomenology, life stressors, and precipitating life events were analyzed.

**Results:** A total of 47 patients (68% female) were identified between the ages of 6 and 20 years old (mean = 13). The most common phenomenologies were tics (36.2%) and tremor (36.2%). Significant life stressors and related precipitating events were identified in 87%, prior to PMD onset. The most common stressors were categorized as social (29.4%), academic (23.5%), and family (20.5%). Per parental report, 23 children (48.9%) performed above average academically.

**Conclusions:** Experiencing major stressors and gender seem to affect the development of a PMD, similar to adults. However, the phenomenology of the movement is different, as children are more likely than adults to present with pseudo tics. Careful neurological and psychological assessment is needed when diagnosing patients with a PMD.

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**J.G. KEILP, M. GORLYN, M. RUSSELL, J. HARKAVY-FRIEDMAN, M.A. OQUENDO & J.J. MANN. Executive Dysfunction in Suicidal Behavior: A Correlate of Violence not Attempt Risk.**

**Objective:** Neuropsychological dysfunction is associated with risk for suicidal behavior in depression. We had previously reported that suicidal behavior in depression was associated with deficits in attention and memory, especially tests assessing attention control, but not standard executive function measures - in contrast to other studies. In this study, characteristics of past suicide attempts, including choice of method (violent vs. non-violent), lethality (degree of medical damage), and degree of intent to die (both subjective and objective) were examined in relation to executive dysfunction.

**Participants and Methods:** Subjects were 88 depressed subjects with a prior history of suicide attempt and 85 depressed subjects with no history of attempt. All subjects were currently depressed and medication-free at the time of assessment. Executive function measures included the Wisconsin Card Sort, a computerized Object Alternation Task, and a Go-No Go Task. The latter two tasks were selected for their sensitivity to ventral prefrontal dysfunction.

**Results:** Although past suicide attempters, as a group, did not differ from depressed non-attempters on any measure, violent attempters performed more poorly on Object Alternation and Go-No Go relative to both non-violent attempters and non-attempters. However, the most lethal attempters, who primarily used non-violent methods, paradoxically outperformed other depressed groups in Object Alternation. Both lethality of past attempts and better performance on Object Alternation were associated with higher suicide intent, especially objective evidence of planning the attempt.

**Conclusions:** Executive dysfunction was found in past attempters who had made violent attempts, but executive function was intact among those who had made the most highly planned, highly lethal non-violent attempts. Executive dysfunction, appears to be associated with violence in the context of suicidal behavior, but not the risk for suicidal behavior itself.

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**W.D. KILLGORE, J.C. BRITTON, L.M. PRICE, A.L. GOLD, T. DECKERSBACH & S.L. RAUCH. Amygdala Responses of Specific Animal Phobics Do Not Differ from Healthy Controls During Masked Fearful Face Perception.**

**Objective:** The amygdala plays a key role in conditioned fear and the response to threat related cues. Exaggerated responsivity of the amygdala to a broad range of threat-related stimuli has been hypothesized to contribute to the pathophysiology of various anxiety disorders. Specific phobias, however, may be qualitatively distinct from other anxiety disorders, as elevated amygdala responses may be restricted to stimuli that directly reflect a specifically feared object or situation. The technique of backward stimulus masking of fearful faces has been used successfully to evoke amygdala responses in a variety of anxiety disorders but has never been applied in a functional imaging study of individuals with specific animal phobia (SAP).

**Participants and Methods:** The amygdala responses of SAP (n=17) and healthy control (HC; n=14) adults were compared during functional magnetic resonance imaging (fMRI) in response to masked presentations of fearful versus neutral faces. Groups were compared voxelwise at the whole brain level ( $p < .001$ , uncorrected,  $k=10$ ), and at a much more liberal threshold ( $p < .05$ , uncorrected,  $k=5$ ) within search territories restricted to the left and right amygdala.

**Results:** At the whole brain level, the HC group showed significantly greater activation than the SAP group within primary and secondary visual cortices, whereas the SAP group showed no regions of greater activation than HCs. Moreover, even at an extremely liberal statistical threshold, the groups failed to show task-related differences within either amygdala.

**Conclusions:** Findings are consistent with recent suggestions that a general and non-specific exaggerated amygdala response to fearful face stimuli may not be a feature of specific phobia.

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**W.D. KILLGORE, J.C. BRITTON, L.M. PRICE, A.L. GOLD, T. DECKERSBACH & S.L. RAUCH. Small Animal Phobics Show Sustained Amygdala Activation in Response to Masked Happy Facial Expressions.**

**Objective:** Individuals with specific phobias exhibit exaggerated amygdala responses to feared objects and situations. Although a number of functional neuroimaging studies have examined the pattern of amygdala

responses to threatening cues, it remains unknown whether individuals with small animal phobia (SAP) show differential amygdala activation in the presence of biologically relevant cues representing safety. Some evidence in healthy controls (HC) suggests that happy faces, even when perceived below the threshold of conscious awareness, may serve as safety cues that lead to significantly reduced amygdala activation versus similarly presented fearful faces.

**Participants and Methods:** We therefore compared the amygdala responses of SAP (n=17) and HC (n=14) adults during functional magnetic resonance imaging (fMRI) in response to backward masked presentations of faces expressing happy affect versus neutral faces ( $p < .001$ , uncorrected,  $k=10$ ).

**Results:** Voxelwise whole-brain analysis revealed a cluster of significantly greater left amygdala activation for masked happy faces in SAP versus HC subjects. Signal intensity data were extracted from this cluster. The SAP group demonstrated increased left amygdala activation in the presence of these safety cues ( $p = .04$ ), whereas the HC group showed significant deactivation in left amygdala activation to masked happy faces relative to masked neutral faces ( $p = .002$ ). No differences were observed between groups for the right amygdala.

**Conclusions:** These findings suggest that individuals with SAP may fail to show a normal deactivation of the amygdala in the presence of cues reflecting safety, which may contribute to the pathogenesis and maintenance of fears that are excessive and unreasonable.

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**E.A. LONG, P.K. SHEAR & M.P. DELBELLO. Facial Affect Labeling and Social Judgments in Adolescents with Bipolar Disorder in Mixed or Depressed Mood States.**

**Objective:** Manic adolescents with bipolar disorder-I (BPD) demonstrate deficient facial affect processing; however, performance in other mood states is unknown. This study examined affect processing abilities in adolescents with mixed (BPD-M) or depressed mood states (BPD-D) and in healthy volunteers (HV). Additionally, we examined the relationship between facial affect labeling and social decision-making.

**Participants and Methods:** Participants were 12 adolescents with BPD-M, 5 with BPD-D, and 12 HV (ages 12-17). They completed a forced-choice facial affect labeling task and two novel facial affect interpretation tasks, generating measures of accuracy and RT. Groups were also compared on mood, psychotic symptoms, demographics and several cognitive abilities.

**Results:** On accuracy, BPD-M and BPD-D patients had greater difficulty than HV labeling fearful faces ( $p = .008$ ;  $p = .004$ ). BPD-D had greater difficulty labeling neutral faces than BPD-M patients ( $p = .03$ ). On the forced choice interpretation task, BPD-D patients made poorer social decisions than HV ( $p = .04$ ); no other tasks revealed significant group differences. For RT, all groups performed similarly on labeling. On the interpretative tasks, the BPD-M group responded significantly faster than HV when rating happy faces ( $p = .03$ ), faster than BPD-D patients when selecting between happy and angry ( $p = .04$ ) and happy and fearful faces ( $p = .018$ ) and when rating happy ( $p = .009$ ), angry ( $p = .004$ ) and fearful faces ( $p = .02$ ). RT was similar for BPD-D and HV on all tasks.

**Conclusions:** The findings suggest a mild labeling deficiency in adolescents with BPD-M and BPD-D, with particular difficulty labeling negative emotions. Group differences in labeling accuracy and RT suggest mood state distinctions exist on affect processing tasks.

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**S. LUNDY, R.J. THOMA & J. SMITH. Conditional-Associative Learning in Female Undergraduates "At-Risk" for Anorexia Nervosa and Obsessive-Compulsive Disorder.**

**Objective:** Prior research has demonstrated numerous symptomatological, biological, neuroanatomical, and neuropsychological similarities between Anorexia Nervosa (AN) and Obsessive-Compulsive Disorder (OCD). Neuropsychological similarities in particular may be useful

in understanding cognitive traits associated with these disorders. Symptoms of AN and OCD can be seen in less extreme forms in individuals who may have subclinical versions of these disorders. Neuropsychological studies with these “at-risk” populations have been somewhat helpful in determining which cognitive deficits may be underlying in both disorders, but conclusions have been limited by methodological differences. The present study examined performance on identical neuropsychological tests sensitive to frontal lobe functions in females at-risk for AN, OCD, or both. We hypothesized that the at-risk groups would show disorder-relevant attentional biases when presented with emotionally salient and neutral test items.

**Participants and Methods:** Sixty female undergraduates (15 AN-Risk; 14 OCD-Risk; 19 AN/OCD-Risk; 12 NC) were administered a neuropsychological battery which included a conditional-associative learning task with AN- and OCD-relevant and neutral words.

**Results:** MANOVAs were used to compare AR groups to the NC group on all conditions. Nonsignificant trends in line with hypotheses were found for performance on the neutral condition, with at-risk groups having higher error ratios.

**Conclusions:** Results suggested that cognitive profiles regarding attentional biases in these at-risk groups are similar, though lesser in degree, to those in the corresponding clinical groups.

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**S. MACKIN, G.N. SAVLA, E. GILLUNG, L. AYALON, E. MCKAY & P. AREAN. Suicidal Ideation is Associated with Poorer Performance on Measures of Executive Functioning in Individuals with Late Life Depression.**

**Objective:** Late life depression is a prevalent and debilitating disorder that is commonly associated with mild impairments across several cognitive domains. A common feature of LLD is suicidal ideation (SI); however few studies have evaluated the impact of SI on cognitive functioning in LLD. The purpose of this study was to compare cognitive performance for LLD individuals with SI to that of LLD individuals without SI.

**Participants and Methods:** Participants included 45 elderly depressed patients participating in a larger NIMH funded randomized clinical trial. Severity of suicidal ideation was assessed utilizing the Beck Scale for Suicide Ideation and depression severity was assessed with the Hamilton Depression Rating Scale. Cognitive functioning for all participants was evaluated utilizing a comprehensive neuropsychological battery. Cognitive domain index scores (executive functioning, abstract reasoning, visuospatial, attention, language, memory, speed of information processing) were calculated for each participant. Cognitive impairment was defined as performance falling below the 10th percentile when referenced to age and education matched peers.

**Results:** Cognitive impairment in at least one cognitive domain was demonstrated by 55% of the sample. LLD individuals with SI demonstrated poorer performance on measures of Executive Functioning (EF) than Non-SI participants [ $F(2,45) = 3.23, p = .049$ ]. Results of a linear regression analysis [ $F(2, 33) = 3.47, p = .044$ ] indicated that severity of SI, but not depression severity, was a significant predictor of EF in this sample.

**Conclusions:** Elderly depressed patients are at significant risk for cognitive impairment. LLD individuals with SI may be at higher risk for deficits of EF than depressed individuals without SI.

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**N.C. MCLAUGHLIN, P. MALLOY, R. MARS LAND, G. NOREN, S. RASMUSSEN & B. GREENBERG. Five Year Follow-Up of Gamma Knife Ventral Capsulotomy for Treatment Resistant Obsessive Compulsive Disorder: Preliminary Results.**

**Objective:** Obsessive compulsive disorder (OCD) is a major psychiatric illness that is characterized by intrusive anxiety provoking thoughts (ob-

sessions) and repetitive ritualized behaviors (compulsions). After other avenues of treatment have been attempted, gamma knife capsulotomy has been used as a treatment for obsessive-compulsive disorder. Although research in the area of neurosurgery for psychiatric disorders is expanding, to the author’s knowledge, there have been no other studies examining long-term follow-up using a neuropsychological battery that is as comprehensive as the battery presented in this research.

**Participants and Methods:** Eight individuals with severe and chronic obsessive-compulsive disorder who failed to improve after aggressive conventional behavioral and medication treatments underwent gamma knife ventral capsulotomy. They received comprehensive neuropsychological testing before radiosurgery and at multiple time points after radiosurgery. The 5 year neuropsychological follow-up of these patients is presented.

**Results:** There was a significant improvement in Performance IQ and nonperseverative errors on the Wisconsin Card Sort Test (WCST), with trends toward significant improvement in Full Scale IQ, phonemic fluency, all errors and perseverative errors on the WCST, confrontation naming, and nonverbal memory. Overall, mean scores for groups improved on the majority of assessed measures.

**Conclusions:** This study indicates that gamma knife ventral capsulotomy for obsessive-compulsive disorder does not cause long-term negative changes in cognition, and in fact, may improve cognitive performance in certain domains.

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**C. SADLER, C.A. NOGGLE, K. BAXTER, L. CHAPMAN & J.C. THOMPSON. Degree to which Ratings on the Geriatric Depression Scale Demonstrate a Linear Relationship with Neurocognitive Outcomes on RBANS Domains.**

**Objective:** While a general relationship between depression in the elderly and cognitive impairments has been established, less has been reported on the degree to which this relationship follows a linear path. The current study investigated the relationship of the GDS and cognitive performance on the RBANS indices to determine the relative strength of this tie and whether it is linear in nature.

**Participants and Methods:** An archival data set was utilized. Participants included 77 elderly individuals (>60yrs.) referred for neuropsychological evaluation for a variety of chief complaints who were administered both the Geriatric Depression Scale (GDS) and the RBANS. Statistical comparisons were made between GDS ratings and the five RBANS indices.

**Results:** Statistical analyses revealed the primary cognitive domain of impact in inflated depression was Immediate Memory. Specifically, ratings in the GDS and RBANS Immediate Memory indices demonstrated a significant negative relationship with one another that followed a weak linear path. As elderly individuals reported higher levels of depressive symptoms, performance in immediate memory declined. However, of note, relationships between the GDS and additional RBANS indices were also negative in direction; however, they did not reach significance.

**Conclusions:** Results carry clinical implications as they speak to the relationship of depression in elderly patients and performance on the RBANS, narrowly, and cognitive functioning, broadly. While results seem minimal they remain important in that they emphasize the need to not overgeneralize the impact depression may be having on cognitive presentation in elderly patients which may lead to practitioners not considering additional underlying neurological pathology

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**C. SADLER, C.A. NOGGLE, L. CHAPMAN & J.C. THOMPSON. Profile Renderings of the MMPI-2 in a Sample of Patients Diagnosed with Fibromyalgia.**

**Objective:** As reported prevalence rates of Fibromyalgia continue to climb, the features and etiology remain perplexing and controversial.

Although Fibromyalgia continues to not fit the traditional biomedical model of illness, the lack of physiological correlates suggests a psychological etiology as the most probable. Nevertheless, there is need for greater establishment of the psychological believed to be at play. The current study sought to outline the emerging MMPI profiles of a population of patients with Fibromyalgia.

**Participants and Methods:** An archival data set was utilized for the present study. Participants included 23 patients diagnosed with Fibromyalgia who completed the MMPI-2 as part of a neuropsychological assessment. Profiles were compared against normative sample means to determine significance.

**Results:** Statistical profile analyses revealed patients with Fibromyalgia presented with significant elevations on a number of clinical scales. Specifically, clinically significant elevations were seen on Hypochondriasis (mean = 81.52), Depression (mean = 76.17), Hysteria (mean = 80.04), Psychasthenia (mean = 71.00), and Schizophrenia (mean = 75.22).

**Conclusions:** Results are of clinical and empirical importance as they outline the MMPI-2 profiles of patients with Fibromyalgia. While findings do not distinctly suggest a psychogenic basis of this presentation, results may be seen as evidentiary support of psychological factors playing a role in either the manifestation and/or maintenance of its' associated symptoms.

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#### R. ROSTAMI & F. DEGHANI. The Effectiveness of Neurofeedback Treatment on Psychopathological Symptoms, Craving and Abnormal Brain Activities in Opiate Dependent Patients.

**Symposium Description:** Objective: This study was carried to examine effectiveness of neurofeedback treatment on psychopathological symptoms, craving indexes and abnormalities in brain activities in opiate dependant patients. Method: In this experimental study pre- and post test with control group design, twenty volunteers undergoing an medicine inpatient substance dependent program, were chosen in an arbitrary way, and were matched and assigned to experimental and control groups. Experimental group received 30 sessions neurofeedback after their medicine. During this time, control subjects just received usual medicine treatment. Neurofeedback included SMR training on Cz, followed by an alpha-theta protocol on Pz. Data were gathered by examining all subjects with Symptom Checklist-90-Revised (SCL-90-R), Heroin Craving Questionary (HCQ), and Quantitative Electro Encephalo Gram (QEEG), before and after treatment term. Results: The results of multivariate analysis of covariance (MANCOVA) showed that experimental group had an significant decrease in hypochondriasis, obsession, interpersonal sensitivity, aggression, psychosis, and general symptomatic index, and also anticipation of positive outcome and relief from withdrawal on withdrawal, desire to use substance, and total average score of craving, and finally an improve in Delta (frontal, central and parietal), Theta (frontal and central), Alpha (parietal), SMR (frontal and central) brain waves, in comparison with control group. Conclusion: The neurofeedback treatment with medicine, on improvement of psychopathological and neurological symptoms and intensity of craving in opiate dependent patients, is more effective than usual medicine treatments.

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#### M.T. WAGNER, A. SOPER, A. MITHOEFOR & M. MITHOEFOR. Risk Assessment of Cognitive Morbidity Associated With the Use of Therapeutic MDMA.

**Objective:** A Phase II, FDA-approved, randomized, double-blinded, placebo-controlled pilot study was conducted to investigate the use of methylenedioxymethamphetamine (MDMA) as a psychopharma-

cological adjunctive to psychotherapy. The overall aim of the study was to test safety, efficacy and mechanisms of action of MDMA as an adjunct to psychotherapy for subjects with PTSD. We reported a significant treatment effect in reducing PTSD symptomatology elsewhere (Mithoefer, 2008). We now present cognitive outcome data from this study.

**Participants and Methods:** Twenty-one subjects were randomly assigned to psychotherapy (N = 8) or medication adjunctive psychotherapy (N = 13). Both groups received 2 psychotherapy treatment sessions 3-5 weeks apart. At each session, the experimental group received 125 mg of MDMA, and the control group received the placebo drug.

**Results:** Regression analyses showed no significant effect of treatment on cognitive functioning, as measured by the RBANS, PASAT, or Rey Complex Figure. However, within the experimental group, t-tests showed significant mean differences between pre- and post-test on RBANS immediate memory ( $t[12] = 3.06, p=.01$ ), and Rey 3-minute ( $t[12]=2.43, p=.03$ ) and 30-minute ( $t[11] = 2.89, p=.02$ ) delays, in which cognitive functioning was improved at post-test. PASAT Trial 1 scores were marginally improved ( $t[12] = 2.00, p=.07$ ). Other aspects of cognitive functioning showed improvements that did not approach significance (i.e., PASAT Trial 2 and other RBANS domains).

**Conclusions:** Despite controversy surrounding the neurotoxicity of MDMA, we found no between-group differences on cognitive functioning. Within the treatment group, the trend was for improvement of cognitive scores probably secondary to resolving inattentive features associated with PTSD.

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#### L. VELLA, C.Z. BURTON, R.K. HEATON, D.V. JESTE & E.W. TWAMLEY. Correlates of Work History and Work Attainment in Supported Employment for People with Severe Mental Illness.

**Objective:** Individuals with severe mental illness seeking work face numerous obstacles, including neuropsychological impairments and psychiatric symptoms. These factors may have influenced prior work performance and could influence employment outcomes in work rehabilitation. In a treatment study examining the effectiveness of supported employment, we expected baseline neuropsychological functioning, psychiatric symptom severity, and everyday functioning ability to be correlated with both work history and work outcomes.

**Participants and Methods:** Sixty-eight unemployed outpatients received supported employment services for one year. The participants were aged 22-61 and were diagnosed with schizophrenia, schizoaffective disorder, major depressive disorder, or bipolar disorder. Baseline assessments included tests of attention, processing speed, working memory, learning, memory, and executive functioning, measures of psychiatric symptom severity (positive, negative, and depressive symptoms), and an assessment of everyday functioning capacity. Past work variables included recency of last work and lifetime percentage of adult employment. The main work outcome was achievement of competitive work.

**Results:** Participants spent 54.9% (SD=29.1%) of their adult lifetime employed. Competitive work was achieved by 64.2% of the participants. With Bonferroni corrections, no relationships were found between neuropsychological or psychiatric symptom domains and either past work experience or attainment of competitive work.

**Conclusions:** Unlike prior research findings, individuals in this work rehabilitation sample showed no evidence that neuropsychological deficits or psychiatric symptom severity were related to either work history or work attainment. With its emphasis on matching clients to jobs across the job skill spectrum, supported employment may help clients bypass neuropsychological impairments by matching them with jobs that capitalize on cognitive and other strengths.

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**S.L. WRIGHT, E. AVERY, A.M. KADE, M.T. RANSOM, B. GIOR-DANI & S.A. LANGENECKER. The Double Burden of Age and Depression on Verbal Learning and Memory.**

**Objective:** Few studies have explored how aging interacts with depression in producing learning and memory decrements. The current study was designed to assess the impact of age on visual and verbal learning and memory during depression. We hypothesized that depression and age would interact in predicting learning and memory performance.

**Participants and Methods:** Seventeen young (M age=33.06) and nine elder (M age=62.67) individuals with MDD and 35 young (M age=31.4) and 10 elder (M age=61.4) healthy controls (M age=62.67) were administered the California Verbal Learning Test-2 (CVLT-2) and the Michigan Spatial Relations Test (MSRT). Two separate 2 (age group) X 2 (MDD status) repeated measures (rm) ANOVAs were conducted for each measure, with five learning trials and two recall trials [short (SDFR) and long delay free recall (LDFR)], respectively, identified as within-subject variables.

**Results:** For the CVLT in both rmANOVAs, there were significant effects of age and depression status, with elder and MDD groups performing more poorly than their counterparts ( $p < .03$ ). For CVLT delayed recall trials, there was also a marginally significant interaction of age and depression status ( $p = .06$ ), with the elder MDD group performing more poorly than the other three groups for SDFR and more poorly than both younger groups for LDFR. For the MSRT, only effects of age were detected ( $p < .03$ ).

**Conclusions:** Results support the contention that age and depression result in a double burden in select areas of memory. Findings are discussed in the context of neurobiological changes thought to accompany depression and aging that might function to negatively impact learning and memory.

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### Psychopathology/Neuropsychiatry (Schizophrenia)

**M.T. AMLUNG, M.V. VALTCHEVA & J.E. MCDOWELL. Saccadic Performance and Its Relation to Self-Report Ratings of Schizotypy in Undergraduates.**

**Objective:** Antisaccade performance is a putative endophenotype for schizophrenia, as people with the illness, their biological relatives, and people high on schizotypy have poor performance on this task. To further investigate the relationship between anti-performance and schizophrenia-related symptoms, undergraduates with good and poor antisaccade performance were measured on a series of clinical scales.

**Participants and Methods:** Undergraduate students ( $N=350$ ) with no history of psychiatric illness participated in an eye movement paradigm involving prosaccade and antisaccade tasks (requiring generation of glances towards or away from a visual cue, respectively) and answered self-report questionnaires measuring schizotypy (Schizotypal Personality Questionnaire; Chapman Rating Scales) and depression (Beck Depression Inventory).

**Results:** In the overall sample, higher schizotypy ratings were associated with slower antisaccade latencies. Groups of good and poor performers on the antisaccade task (corresponding to the upper and lower 33% of the distribution), were then compared. There were no significant between-group differences in mean clinical scale scores, but interesting within-group correlations were evident. In both groups, endorsement of a greater number of cognitive-perceptual distortion items was significantly associated with slower prosaccade latencies. In the good performing group, endorsement of more schizotypal characteristics was significantly associated with more antisaccade errors.

**Conclusions:** Results from this study replicate and extend previous research demonstrating that disruption of antisaccade performance is

observed in college students with higher ratings of schizotypal features. Moreover, these relationships may affect good and poor antisaccade performers differently, suggesting a potential interaction between individual differences in inhibitory processing and schizotypal personality characteristics.

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**A.J. HUANG, R.C. CHAN, X. LU, Z. MA & Z. LI. Effect of conversation prosody on emotion and intention identification in schizophrenia.**

**Objective:** Emotion perception deficits have been well documented in schizophrenia. However, previous studies mainly limit to the investigation of the identification of simple tone-matching prosody rooted in some basic human emotions such as happy, anger, fear or sad rather than some 'subtle' emotion usually implicated by prosody. The present study aimed to examine whether patients with schizophrenia experience difficulties in decoding other people's emotional cues, such as prosody, in daily conversations.

**Participants and Methods:** Eighteen schizophrenic and nineteen demographically matched controls were administered an emotion and intention identification task in the form of a series of conversations with a prosody manipulation and a questionnaire that specifically captured subjective experiences of pleasure.

**Results:** Compared with the healthy controls, the patients with schizophrenia exhibited a chance-level performance in emotion identification in the presence of negative prosody. Furthermore, there was a significant correlation between pleasure experience and failure in both emotion and intention identification.

**Conclusions:** The current study supports the notion that patients with schizophrenia have a specific deficit in recognizing negative emotion, and that their own pleasure experience is related to their comprehension of the emotion and intention state of others.

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**L.M. FRANTI, S.A. LANGENECKER, A.M. KADE, E. SAUNDERS & M.G. MCINNIS. Problem Solving and Spatial Working Memory Decrements in Bipolar Patients.**

**Objective:** Previous research has utilized CANTAB to demonstrate differences between healthy controls (HC) and patients with Bipolar Disorder (BPD) in executive functions (EF) and spatial working memory (SWM). The present study aims to expand upon those findings showing HC groups perform better than BPD groups on CANTAB tasks Stockings of Cambridge (SOC) and Spatial Working Memory (SWM).

**Participants and Methods:** The study sample included 126 BPD (66% female, 34% male) and 52 HC (54 percent female, 46% male) adults aged 19 to 66 ( $M = 39.0 \pm 13.2$ ) and with 11-21 years of education ( $M = 15.3 \pm 2.3$ ). Participants were recruited for a longitudinal study of Bipolar Disorder at the University of Michigan. Diagnostic interviews, genetic testing and a neuropsychological test battery including CANTAB were administered to every participant.

**Results:** Repeated measures ANOVAs run for both SOC (4 HC and 16 BPD outliers excluded) and SWM (6 HC and 14 BPD outliers removed) revealed statistically significant group differences for subsequent thinking time (time after initial move) in SOC and number of within and between errors in SWM (all  $p < .05$ ). HC group performed better than BPD group on both tasks, with faster times and fewer errors committed, respectively.

**Conclusions:** These findings support previous research using CANTAB to demonstrate decreases in EF and SWM in adults with BPD, relative to HCs. Using SOC and SWM we can show declines in problem solving abilities. We explore variables that may cause this difference such as impulsivity, inhibited response styles and genetic markers.

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**M. GIANNAKOU, M.H. KOSMIDIS, V.P. BOZIKAS, G. GARYFALLOS & K. FOKAS. Relationship Between Impaired Theory of Mind and Social Functioning in Schizophrenia.**

**Objective:** Theory of Mind (ToM) refers to our ability to attribute mental states such as beliefs, intentions and desires to others. ToM is considered a component of social cognition, a domain in which patients with schizophrenia are often significantly impaired. In addition, one of the basic symptoms in schizophrenia is severely impaired social functioning. The aim of the present study was to explore the relationship between impaired ToM and patients' social functioning.

**Participants and Methods:** We assessed 40 Greek patients with schizophrenia and 30 healthy participants on ToM and specifically exploring the comprehension of false beliefs (1st and 2nd order ToM), deception (1st and 2nd order ToM), empathy, irony, metaphor and hinting. We also evaluated basic neurocognitive functioning in these groups. Finally, we examined interpersonal skills through three role play scenarios as an indication of social functioning (RP); performance was scored based on fluency of speech/expressive ability, rapport/emotional involvement, and social appropriateness.

**Results:** Patients with schizophrenia performed more poorly than healthy controls on most ToM tests. Their performance on the RP correlated with performance on the following ToM tests: 1st and 2nd order comprehension of false beliefs ( $r=.418, p=.017$ ;  $r=.368, p=.038$ , respectively), 2nd order comprehension of deception ( $r=.405, p=.021$ ) and emotion comprehension in an empathy task ( $r=.479, p=.009$ ). No other correlations were found between social functioning scores and patients' clinical characteristics, demographics and cognitive performance.

**Conclusions:** These findings suggest that remediation of ToM deficits in patients with schizophrenia may improve their social functioning.

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**A.J. GIULIANO, S.R. HOOPER, E. YOUNGSTROM & D. BRIEGER. Neurocognition in Early Onset Schizophrenia and Schizoaffective Disorders.**

**Objective:** The relationship between schizophrenia (SZ) and schizoaffective (SA) disorder is marked by ongoing controversy, and it is unclear whether the level and pattern of neurocognitive deficits in early onset SZ or SA are comparable.

**Participants and Methods:** We examined the neuropsychological functioning (NP) of youth enrolled between 2001-2006 in a NIMH-funded multicenter, longitudinal randomized controlled trial, Treatment of Early-Onset Schizophrenia Spectrum Disorders (TEOSD). We compared the baseline NP of unmedicated SZ ( $n = 32$ ) and SA ( $n = 36$ ) groups, and examined the relationship of clinical symptoms to NP domains. Sample age ranged from 8 to 19 years ( $M = 14.3, SD = 2.4$ ), 66% were male, and 61% Caucasian; diagnosis was confirmed by structured clinical interview across four academic NP domains included IQ, academic achievement, motor, attention, working memory, learning and memory, social cognition, and executive functions.

**Results:** The groups did not differ on any of the NP domains, nor were there any group differences in the percentage of individuals falling one standard deviation or more below the mean on the psychoeducational measures. Significant, but small correlations were noted between select NP domains and the PANSS Negative Symptoms Scale only.

**Conclusions:** There were few meaningful differences between the SZ and SA groups on IQ, achievement, or NP. Findings are largely consistent with the adult literature, contribute to growing interest in the relationship between SZ and SA, and raise questions about the distinctiveness of the SZ-spectrum disorders. Correlations between NP and negative symptoms were small, and also mirror findings in the adult literature.

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**M. MATSUI, M. SUZUKI, S. ZHOU, T. TAKAHASHI, Y. KAWASAKI, H. YUUKI, K. KATO & M. KURACHI. Characteristics of memory strategy and prefrontal brain volume in schizophrenia spectrum disorders.**

**Objective:** The present study investigated the relationship between memory strategy use and prefrontal gray/white matter volumes of healthy control subjects, patients with schizophrenia or schizotypal disorder.

**Participants and Methods:** Gray/white matter volumes were measured for the superior, middle, inferior, ventral medial and orbital prefrontal regions, using high-resolution magnetic resonance images that were acquired from 79 participants including patients with schizophrenia, patients with schizotypal disorder and healthy controls. Participants were also administered the Japanese Verbal Learning Test (JVLTL).

**Results:** In control subjects, larger left inferior frontal and straight gyrus's gray matter volumes were associated with higher semantic clustering rates on the JVLTL, and smaller left inferior frontal gray matter volumes were associated with higher serial clustering ratio. In schizophrenic patients, smaller left orbitofrontal gray matter volumes were associated with lower semantic clustering rates on the JVLTL. In schizotypal patients, smaller left inferior frontal white matter volume was associated with smaller serial clustering rates and larger semantic clustering rate.

**Conclusions:** These findings suggest that semantic organization in schizophrenic patients might depend on mobilization of a memory strategy that is mediated by orbitofrontal cortex functioning. Failure to use a semantic organization strategy might be related to reduced volume in the inferior frontal gyrus. The findings for schizotypal patients suggest a compensation mechanism to remember the words using a serial processing strategy is at work when the inferior frontal gyrus cannot mediate semantic processing.

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**J.L. RITCH, D. TUCKER & D.I. VELLIGAN. Awareness of Cognitive Abilities and the Risk of Self-Report in Schizophrenia.**

**Objective:** Individuals with executive dysfunction perform more poorly on measures of prospective memory (PM). In addition, awareness of one's abilities is also suggested to be mediated by the frontal lobe. The present investigation attempted to elucidate the role of executive functions (EF) in awareness of one's ability utilizing a performance-based and self-report measure of PM in patients with schizophrenia.

**Participants and Methods:** Participants included 53 outpatients diagnosed with schizophrenia who were administered the Wisconsin Card Sorting Test (WCST), Memory of Intentions Screening Test (MIST; performance-based measure of PM) and Prospective Memory Questionnaire (PMQ; self-report measure of PM). The sample was divided into poor and fair EF groups based on WCST scores. Group effects on measures of PM were examined.

**Results:** One-way between subjects ANOVAs were calculated to examine the effects of EF (fair vs. poor) on measures of PM: MIST and PMQ. The analyses produced significant main effects for group for the MIST ( $F(1,51) = 15.09, p = .000$ ) but not for the PMQ ( $F(1,51) = 1.876, p = .177$ ).

**Conclusions:** Individuals exhibiting fair EF significantly outperform individuals with poor EF on a performance-based measure of PM. However, no difference between the fair and poor EF groups was found on a self-report measure. Both groups indicated that they infrequently failed to perform PM tasks. Findings support the hypothesis that individuals with poor EF are less reliable in their reported abilities compared to individuals with better EF. These results have serious implications for any research where self-report measures are utilized in populations having known executive dysfunction.

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**C. SETER, S. WORTH, R.K. KESSLER, P.L. BRITNELL & T. GIOVANNETTI. Characterizing Planning Behaviors in Schizophrenia: An Analysis of Everyday Action.**

**Objective:** Planning is an executive function that has been limitedly studied in everyday tasks (e.g., meal preparation) and in individuals with schizophrenia. This pilot study examined evidence for planning and planning failures in participants with schizophrenia and healthy controls engaged in everyday tasks.

**Participants and Methods:** Eighteen inpatients with schizophrenia and 16 healthy controls were administered the Naturalistic Action Test (NAT), a performance-based test of everyday functioning. Errors were coded according to the test manual. Additionally, NAT performance was coded for 1) proactive planning behaviors (e.g., gathering objects before engaging in a subtask), 2) planning errors (e.g., performing task steps in an inefficient sequence), and 3) planning time (i.e., time elapsed before beginning a task).

**Results:** Schizophrenia patients demonstrated significantly more errors on tasks than controls. Planning variables were reliably coded (88% agreement between 2 coders) and were uncorrelated with each other. Control participants engaged in significantly more planning behaviors than schizophrenia patients ( $t(26) = 2.459, p < .05$ ). Although no significant group differences were found for planning errors or planning time, planning time was significantly more variable within the schizophrenia group.

**Conclusions:** Planning behaviors may be reliably measured from videotapes of participants performing everyday tasks. Different planning measures may reflect independent aspects of everyday planning, with only proactive planning behaviors differentiating people with schizophrenia from controls. These findings suggest that specific planning strategies may facilitate everyday functioning in people with schizophrenia.

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**Invited Symposium:  
Multidisciplinary Perspectives on Prefrontal  
Function and Dysfunction in Development,  
Adulthood, and Aging**

**Chair: Paul Eslinger**

**10:15 a.m.–12:00 p.m.**

**P.J. ESLINGER, V. ANDERSON, J. GRAFMAN & P.J. ESLINGER. Multidisciplinary Perspectives on Prefrontal Function and Dysfunction in Development, Adulthood, and Aging.**

**Symposium Description:** The prefrontal cortex has been implicated in important aspects of cognition, emotion, and behavior throughout multiple phases of development, maturation, and aging. Converging anatomical, physiological, imaging, and behavioral data support important roles for the prefrontal cortex in executive functions, self-regulation, and social cognition. Both lesion effect and brain imaging approaches further suggest that the prefrontal cortex is vital for continuing adaptation throughout life, though with vastly different challenges at different ages. This symposium is organized to identify and highlight several of the functional roles of the prefrontal cortex that appear to be specific to developmental, adult, and aging adaptation, and core prefrontal functions that have high similarity across the lifespan. These potentially include acquiring and utilizing social roles, engagement in goal-directed behavior, elaborating self-other knowledge, emotional and behavioral regulation, working memory, perspective-taking, and em-

pathic abilities. Presenters will address questions such as what experiential and biological factors contribute to maturation and maintenance of healthy prefrontal cortical systems. How might social, executive and self-regulatory functions in one phase influence subsequent phases? What are the continuities in prefrontal functions that naturally transition across the lifespan and where can discontinuities pose significant problems? How might these discontinuities be ameliorated? Can a consistent role for the prefrontal cortex be identified throughout life?

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**V. ANDERSON. The prefrontal cortex in children: No longer the silent?**

**Objective:** For many years, research addressing normal development has documented rapid neuroanatomical change within the pre-frontal cortex during childhood and adolescence. In contrast, until quite recently, it has been argued that prefrontal regions are 'functionally silent' during early development. With the advent of sophisticated neuroimaging techniques and age appropriate measures of both 'hot' and 'cold' executive function, it is now clear that the prefrontal cortices and the functions they subsume are, in fact, highly active, even in early childhood. More recently, anatomical maturation and links to cognitive development have been explored, with expected parallels reported between brain and behaviour dimensions.

On this backdrop of normal development, the impact of disruption, due to brain injury and related risk factors, has begun to be explored. Findings suggest that insult to the developing brain, and in particular prefrontal regions, can have serious and long-standing effects, although predicting prognosis remains a challenge. This presentation will describe current perspectives on normal prefrontal development, and its functional implications and consider the impact of interruptions to this process for the developing brain.

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**J. GRAFMAN. The Representation of a Life-Span in the Adult Human Prefrontal Cortex.**

**Objective:** Being able to establish routine patterns of activity provides a predictable and thus a secure means of behaving in life. Routines are not always useful when adapting to unpredictable events and on occasion humans have to be able to adjust routines to accomplish a goal. The ability to combine and store behaviors that are routine and adaptive help build the representation of the expectations of a typical human life-span in the adult. These representations are mature but built upon some aspects of the experiences of childhood and adolescence. They do not encompass the personal experience and limitations of the older adult. In my presentation, I will present data from mostly adult patients and functional neuroimaging studies of normal adult volunteers that suggests that different regions of the prefrontal cortex are especially suited for routine and adaptive behaviors, that human foresight and remembrance depends not only upon the hippocampus but crucially upon the frontopolar cortex, and that our sense of self emerges from the cooperative activity of all these prefrontal cortex regions.

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**P.J. ESLINGER. Executive Aging: Continuing Social and Cognitive Adaptation with Changing Resources.**

**Objective:** There is increasing recognition that social cognition and executive functions change with aging, and that the prefrontal regions may be more vulnerable to the effects of aging. The current strengths and limitations of these contentions will be examined from experimental and clinical perspectives. An important challenge is to identify those changes

that are most problematic for an individual's functional independence and that may be strong predictors of progressive cognitive decline. Several of these concerns have been highlighted by recent studies of frontotemporal dementia and other neurodegenerative conditions where executive and social cognitive impairments are most prominent. It has also been claimed that many community-dwelling older persons, without dementia, may exhibit working memory, decision-making, and social cognitive difficulties, at least on testing, but the predictive value of these impairment is currently uncertain. In this presentation, I will highlight both imaging and cognitive findings with regard to executive aging and how they relate to aging adaptations, cognitive aging and mild cognitive impairment.

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#### Paper Session 4: Imaging

10:45 a.m.–12:15 p.m.

**J.L. WOODARD, K.A. NIELSON, M. SEIDENBERG, S. DURGERIAN, Q. ZHANG, P. ANTUONO & S.M. RAO. Prediction of Cognitive Decline in Older Adults over 1.5 Years with Functional Magnetic Resonance Imaging.**

**Objective:** Functional magnetic resonance imaging (fMRI) has emerged as a candidate biomarker for functional changes in the central nervous system that may underlie cognitive decline. However, few longitudinal investigations have studied the extent to which fMRI activation patterns can predict future cognitive performance. This study evaluated whether fMRI can predict future cognitive decline independently of other predictors.

**Participants and Methods:** Neuropsychological testing and fMRI using a famous name recognition paradigm were performed on 78 participants (M-age= 73 years, SD=4.9 years, range=65 to 88 years; 73% female) at baseline and 1.5 years later. Baseline measurements of hippocampal volumes were also obtained. A positive family history of dementia and the Apolipoprotein E (APOE)  $\epsilon 4$  allele were present in 51.3% and 33.3% of the sample, respectively.

**Results:** After 1.5 years, 26.9% of the sample declined by 1 SD or more on at least one neuropsychological measure. Using logistic regression, demographic variables (age, years of education, gender), presence of the APOE  $\epsilon 4$  allele, dementia family history, and hippocampal volume did not predict future cognitive change. However, greater baseline fMRI activity in both cortical ( $p < .005$ ) and hippocampal/subcortical ( $p < .04$ ) networks was associated with a reduced likelihood of future cognitive decline. Overall classification accuracy was 82.1%.

**Conclusions:** fMRI activation at baseline was an independent predictor of cognitive decline 1.5 years later. We conclude that fMRI measures are more sensitive to the dynamic functional state of the brain, making them more likely to predict future cognitive change than static indicators, such as demographic variables, dementia family history, APOE  $\epsilon 4$  status and hippocampal volume.

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**A.M. BRICKMAN, K.L. SIEDLECKI, J. MURASKIN, J.J. MANLY, T.R. BROWN, C. DECARLI & Y. STERN. White Matter Hyperintensities and Cognition: Testing the Reserve Hypothesis.**

**Objective:** White matter hyperintensities (WMH) are areas of increased signal intensity appearing on T2-weighted MRI. Thought to reflect small vessel vascular disease, they are among the most ubiquitous radiologi-

cal findings in older adults. Much like other markers of brain disease, the association between WMH and cognition is imperfect. The concept of reserve may account for this imperfect relationship. The purpose of this study was to test the reserve hypothesis in the association between WMH severity and cognition.

**Participants and Methods:** Neurologically healthy older adults ( $n=717$ ) from a community-based study received structural MRI, neuropsychological assessment, and evaluation of reserve. WMH volume was quantified algorithmically and log transformed for analysis. Using structural equation modeling, we derived latent constructs representing three neuropsychological domains (memory, visuospatial, executive/speed), a measure of reserve representing cumulative psychosocial/intellectual experiences (e.g., education), and a measure of reserve representing quality of physical growth and development (e.g., cranial anthropometry).

**Results:** Path analysis showed that increased WMH burden was associated with poorer cognition and that both psychosocial and physical estimates of higher reserve were associated with better cognition. Controlling for cognitive functioning, those with psychosocial estimates of higher reserve had significantly greater degrees of WMH burden. These findings were most prominent for executive/speed cognitive tasks among women.

**Conclusions:** The findings are most consistent with the cognitive reserve hypothesis; for any given level of cognitive function, those with psychosocial estimates of higher reserve had more pathology in the form of WMH. Although markers of physical growth and development were associated with cognitive function, they did not mitigate the effect of WMH on cognition.

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**L. DELANO-WOOD, N.H. STRICKER, D. SCHIEHSER, A.J. JAK, Y. CHANG, C.E. WIERENGA, L. TERMINI, D.P. SALMON, L.R. FRANK & M.W. BONDI. APOE  $\epsilon 4$  Genotype Status Predicts Reduced Fornix Integrity in Alzheimer's Disease.**

**Objective:** Recent studies in Alzheimer's disease (AD) have demonstrated volumetric reductions of the fornix, a white matter tract representing the major pathway providing bidirectional connectivity between the hippocampus and subcortical structures. Given that APOE, a major genetic risk factor for AD, has been linked to white matter degeneration, the aim of the current study was to employ diffusion tensor imaging (DTI) to examine the relationship between fornix white matter integrity and APOE genotype in normal aging and AD.

**Participants and Methods:** Forty-three older adults were divided into two groups on the basis of their cognitive status (AD:  $n=21$ ; Normal Control [NC]:  $n=22$ ). Groups were comparable on age, education, gender, APOE genotype, and stroke risk. DTI estimates of fractional anisotropy (FA) of the fornix were obtained from axial slices using color-coded maps as a guide for ROI placement on the FA maps.

**Results:** Relative to NCs, participants with AD demonstrated significantly lower fornix FA. In addition, collapsed across diagnosis, APOE  $\epsilon 4$  genotype was associated with significantly lower fornix FA. After adjusting for diagnosis, age and whole brain volume, multiple hierarchical regression showed that APOE  $\epsilon 4$  status was predictive of poorer fornix FA.

**Conclusions:** Results demonstrate that AD participants show considerably lower fornix FA than NCs and, irrespective of diagnosis, APOE genotype status is independently predictive of poorer fornix FA. Findings further implicate involvement of white matter changes in AD and suggest that possession of the APOE  $\epsilon 4$  allele confers a deleterious effect on fornix integrity in both AD and normal aging.

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**J. FOLEY, P. SIDDARTH, S. BOOKHEIMER, G. BARTZOKIS, K.M. HAYASHI, P.M. THOMPSON, G.W. SMALL & L.M. ERCOLI. Changes in Cerebral Volumes among Healthy Older Adults With and Without the Apolipoprotein Epsilon 4 Genetic Risk for Alzheimer's Disease: A Longitudinal Study.**

**Objective:** We studied longitudinal changes in brain volume in middle-aged and older adults with and without the APOE-4 genetic risk for Alzheimer's disease (AD). Recent evidence (Bartzokis, 2004) suggests preferential degeneration of white matter (WM) in AD; this study addressed the contribution of WM decline among APOE-4 carriers.

**Participants and Methods:** Twenty two nondemented subjects (APOE-4 n=12) underwent MRI imaging at baseline and 2-year follow-up. Cortical pattern matching was used to evaluate change in brain shape and tissue distribution. Cortical flattening and sulcal matching techniques were used to build an average cortical model for subject groups. Subjects were compared on gray matter (GM), WM and the ratio of GM:WM indices.

**Results:** The interaction of age and APOE-4 was associated with an increased GM:WM ratio [ $F(1, 14)=5.56, p=0.03$ ]. In APOE-4 carriers only, increasing age was associated with a significant increase in the GM:WM ratio, which corresponds to a 10% increase over two years in GM:WM per decade of life. No significant group differences or interactions were found for change in GM or WM. Follow up analyses revealed regional trends for the APOE-4 group only, with GM increasing and WM decreasing over time, particularly in late-myelinating, more susceptible regions, including frontal, temporal, and parietal lobes.

**Conclusions:** Persons with APOE-4 showed a 2-year increase in the GM:WM ratio, which differs from expected patterns of change in healthy aging. Findings suggest that APOE-4 status may be associated with accelerated WM breakdown, particularly in later-myelinating regions of the cerebral cortex. Combining MRI and genetics may be useful in selecting or identifying persons for continued follow-up.

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**C. WIERENGA, N.R. STRICKER, L. DELANO-WOOD, A. MCCAULEY, K.J. BANGEN, A.J. JAK, D.P. SALMON & M.W. BONDI. Changes in the Neural Substrates of Semantic Memory in Nondemented Older Apolipoprotein E e4 Carriers.**

**Objective:** Because semantic knowledge and word-finding ability have been shown to deteriorate as much as episodic memory, and more than executive function, during the preclinical period of Alzheimer's disease (AD; Mickes et al., 2007), such changes may serve as a preclinical marker of cognitive decline. Thus, we aimed to identify changes in the neural substrates of object name retrieval in nondemented older adults at genetic risk for AD (APOE e4 carriers).

**Participants and Methods:** Eleven right-handed, native English speaking, nondemented older adults with the APOE e4 allele and 11 age- and education-matched APOE e3 control participants performed an overt event-related confrontation naming task during fMRI. This task has previously been shown to differentiate between the neural substrates responsible for processing category (living vs nonliving) and object attributes (global vs local details) in healthy older adults.

**Results:** Behavioral results indicated no group differences in naming accuracy. BOLD analyses revealed that the APOE e4 group showed greater left lateral frontal (e.g., Broca's area) but less inferior temporal activity compared to their e3 peers. Group (e3 vs e4) X Category (animals, tools, vehicles) interactions were evident in the right and left fusiform gyrus.

**Conclusions:** Findings demonstrated a change in the neural substrates of object naming that was detected in genetically at-risk adults prior to the onset of cognitive decline. Increased frontal activity in the APOE e4 adults is consistent with a compensatory hypothesis whereby increased activity in ostensibly intact frontal regions (related to word retrieval) occurs in response to decreased activity in posterior regions (related to semantic degradation) affected earlier in the disease process.

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**Symposium 4:  
A Neuropsychological Approach to Everyday  
Action: Understanding Impairment to Inform  
Intervention**

**Chair: Tania Giovannetti**

**10:45 a.m.–12:15 p.m.**

**T. GIOVANNETTI. A Neuropsychological Approach to Everyday Action: Understanding Impairment to Inform Intervention.**

**Symposium Description:** Clinical neuropsychologists often are consulted to comment on patients' everyday functional abilities. However, unlike disorders of memory and language, everyday impairment is poorly understood, with a dearth of theoretically motivated interventions in the literature. This symposium includes 5 studies that advance our knowledge of the neurocognitive components of everyday functioning and inform intervention strategies. First, Kessler et al. will propose a model of everyday action impairment that was derived from a detailed analysis of errors in people with schizophrenia. This model has implications for characterizing everyday deficits across diverse populations. Second, Park et al. will show the influence of task familiarity on everyday action impairment in stroke patients. These findings elucidate everyday impairment and contribute to our knowledge of how everyday tasks are learned by healthy people and may be remediated in those with deficits. Third, Bickerton et al. will report that patients with specific action knowledge deficits demonstrate specific patterns of everyday impairment in response to changes in the environment. These authors also show that specific deficits respond differently to intervention strategies. Fourth, Bettcher et al. will evaluate everyday errors and error monitoring in dementia. They will present an environmental intervention that reduced only errors due to executive dysfunction and will demonstrate that everyday impairment in dementia may be attributed to both executive dysfunction and knowledge degradation. Finally, Marson et al. will present a novel instrument that evaluates the everyday tasks that comprise financial capacity. This instrument has the potential to inform treatment planning for people with mild cognitive impairment and dementia. In conclusion, the discussant will offer guidelines for characterizing everyday impairment, a summary of promising interventions, and directions for future research.

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**R.K. KESSLER, P.L. BRITNELL & T. GIOVANNETTI. Principal Component Analysis of Everyday Action Errors in Schizophrenia.**

**Objective:** Individuals with schizophrenia are impaired at performing everyday tasks (i.e. meal preparation), but few studies provide in-depth analyses of action errors. In an earlier study using principle component analysis (PCA) we demonstrated that omission and commission errors reflected distinct aspects of action performance in people with Alzheimer's disease. This study examined whether the constructs underlying everyday action impairment in schizophrenia were similar to those in dementia.

**Participants and Methods:** Forty-two individuals with schizophrenia were administered the Naturalistic Action Test (NAT), a performance-based test of everyday functioning. Errors were classified according to an established taxonomy that includes omission, sequencing, perseveration, substitution, and off-task errors. A PCA of NAT errors was performed with the eigenvalue criterion  $>1$  and varimax rotation. All participants also completed a comprehensive neuropsychological evaluation.

**Results:** Analyses indicated that the data were appropriate for PCA (KMO = .54; Bartlett's test  $p < .001$ ). The PCA yielded a two-component solution, with off-task (.83), sequence (.76), perseveration (.65) and substitution (.59) errors loading on the first component (i.e., commission errors) and omissions loading on the second component (.93). Furthermore, correlations with neuropsychological tests showed that omissions and commissions were related to different neuropsychological variables, with commissions related to measures of executive function.

**Conclusions:** The two-component structure of everyday action performance in schizophrenia is consistent with results from other clinical populations and suggests that omissions and commissions reflect distinct aspects of action impairment. These results support a specific, multidimensional model of everyday action.

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**N.W. PARK, S. LOMBARDI, D.A. GOLD, C.S. LABRISH, E.A. ROY & S.E. BLACK. Cognitive Processes Mediating the Encoding and Production of Novel and Routine Naturalistic Actions.**

**Objective:** We investigated the processes mediating production of novel (unfamiliar) naturalistic actions (NNA; e.g., making a mock volcano) by comparing their performance to routine (familiar) naturalistic actions (NA; e.g., preparing coffee).

**Participants and Methods:** Undergraduates and stroke patients were asked to verbally describe and enact NAs and NNAs after viewing their demonstration.

**Results:** Consistent with prior research, NAs were described primarily in terms of central or basic (crux) actions, whereas non-central or enabling (noncrux) actions were infrequently described. Similar findings were observed in the verbal description of NNAs, but, equivalent proportions of crux and noncrux actions were enacted correctly. In stroke patients, NA and NNA performance revealed that participants with impairments (as assessed by a measure of general cognitive function): (a) enacted fewer crux and noncrux actions accurately and (b) performed more poorly when arranging a scrambled set of photos of NAs and NNAs in the correct order compared to unimpaired stroke patients and matched controls. Detailed error analyses of enactment revealed differences between NAs and NNAs for stroke patients with impairments relative to the other two groups. For NAs, stroke patients with impairments had higher crux and noncrux omission (omitting an action) than commission (performing an action inaccurately) error rates. In contrast, for NNAs, the group with impairments had higher commission than omission error rates for crux actions, but lower commission than omission error rates for noncrux actions.

**Conclusions:** Implications of these findings for understanding the cognitive processes underlying naturalistic action performance will be discussed. Correspondence: *Tania Giovannetti, Ph.D., Psychology, Temple University, 1701 N. 13th Street, Philadelphia, PA 19122. E-mail: tgio@temple.edu*

**W. BICKERTON, G.W. HUMPHREYS & M.J. RIDDOCH. The Investigation of the Interactions between Action and Object Knowledge with Everyday Action of Patients with Neurological Damage.**

**Objective:** Everyday action involves an interaction between our stored knowledge of multi-step tasks and the presence (and availability) of objects in the environment. However, studies have shown that patients' knowledge about action sequences or objects (assessed in isolation) might not predict their everyday task performance. The present study aimed to identify deficits in action or object knowledge in patients having difficulties with performing everyday tasks and to examine if contrasting deficits had differential impact on how changes in the object environment affected task performance.

**Participants and Methods:** Six patients who showed impairments in an apraxia screen were recruited. Their performance on 12 everyday

tasks was compared with age-matched controls in both a baseline condition (with task objects only) and a distractor condition (with 4 distractor objects scattered in the task array). Observations were recorded in terms of action step produced, object selection, object use and temporo-spatial accuracy.

**Results:** The results showed that the effects of the object environment were specific to patients' primary deficits.

**Conclusions:** The data are discussed in terms of Cooper and Shallice's model of everyday action control. The above findings were further supported through rehabilitation attempts to improve performance of two patients (FK and BL) with contrasting deficits. These attempts included strengthening environmental cues (e.g. highlighting the relevant objects among the distractor objects). Contrasting effects could be observed. This implicates the benefits of cognitive analysis of everyday action for rehabilitation planning.

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**B.M. BETTCHER, T. GIOVANNETTI, A. LYON, K. DUEY & D.J. LIBBON. Everyday Error Monitoring Deficits in Dementia: An Environmental Intervention.**

**Objective:** Dementia patients correct fewer action errors than age-matched controls; however, little is known about the neuropsychological derivation of their monitoring difficulties. Executive control and semantic knowledge have been demonstrated to play a role in the implementation of task goals. The current study examines error monitoring and its neuropsychological correlates in an environmental intervention (User-Centered Naturalistic Action Test) designed to improve errors due to failures in executive control.

**Participants and Methods:** Thirty-six dementia patients were administered the Naturalistic Action Test (NAT), a performance-based measure of everyday functioning. The NAT was administered under 2 conditions: standard and user-centered (UC). The UC-NAT included environmental adaptations designed to improve sequence ordering and reduce environmental distractibility. Both conditions were coded for total errors, errors detected, and errors corrected. Correlations between monitoring variables and neuropsychological tests of language, executive functioning, and episodic memory were performed.

**Results:** The UC condition resulted in fewer total errors by dementia patients, but did not improve the proportion of errors corrected. In the standard condition, total error rate was related to measures of executive control ( $r = .455$ ,  $p < .01$ ). In contrast, errors in the UC-condition were related to preserved naming ability ( $r = -.363$ ,  $p < .05$ ). In terms of correction of action errors, the UC-condition was related to preserved naming only ( $r = .41$ ,  $p < .05$ ).

**Conclusions:** The UC-NAT improved action performance in individuals with executive control problems. As predicted, errors and corrections that occurred in this condition were not explained by executive deficits but were related to language and semantic knowledge deficits. The results suggest that functional rehabilitation strategies for dementia patients should focus on executive deficits as well as degradation of task knowledge.

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**D. MARSON, R. MARTIN, V. WADLEY, S. SNYDER, R. GRIFFITH, P. GOODE, C. KINNEY, T. NICHOLAS, T. STEELE, B. ANDERSON, E. ZAMRINI, L. HARRELL, A. BARTILUCCI & R. RAMAN. Clinical Interview Assessment of Financial Capacity in Patients with MCI and Alzheimer's Disease.**

**Objective:** To investigate financial capacity in patients with mild cognitive impairment (MCI) and Alzheimer's disease (AD) using a clinician interview approach.

**Participants and Methods:** The investigators and five study physicians developed a conceptually based, semi-structured clinical interview for

evaluating seven core financial domains and overall financial capacity (Semi-Structured Clinical Interview for Financial Capacity) (SCIFC). The study physicians used the SCIFC to evaluate the financial abilities of healthy older adults (N=75), and patients with amnesic MCI (N=58), mild AD (N=97), and moderate AD (N=31). For each participant, a physician made capacity judgments (capable, marginally capable, or incapable) for each financial domain and for overall capacity.

**Results:** Study physicians made a total of over 11,000 capacity judgments across the study sample (N=261). Very good inter-rater agreement was obtained for the SCIFC judgments. Increasing proportions of marginal and incapable judgment ratings were associated with increasing disease severity across the four study groups. For overall financial capacity, 95 percent of physician judgments for older controls were rated as capable, as compared to only 82% for patients with MCI, 26% for patients with mild AD, and 4% for patients with moderate AD.

**Conclusions:** Financial capacity in cognitively impaired older adults can be reliably evaluated by clinicians using a relatively brief, semi-structured clinical interview. Financial capacity shows mild impairment in MCI, emerging global impairment in mild AD, and advanced global impairment in moderate AD. MCI patients and their families should proactively engage in financial and legal planning given these patients' risk of developing AD and accelerated loss of financial abilities.

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### Poster Session 3: Adult TBI, Intervention, Medical/Neurological Disorders

10:45 a.m.–12:15 p.m.

#### Assessment/Psychometrics/Methods (Adult)

**D.S. TULSKY, N. CARLOZZI, P. KISALA, D. VICTORSON & D. CELLA.** **New Initiatives to Develop Patient Reported Outcome Measures for Research with Neurological Populations.**

**Objective:** NIH has initiated projects designed to re-engineer the clinical research process. The PROMIS and Neuro-QOL initiatives have been designed to develop self-report measures of perceived cognitive function, physical function, pain, fatigue, social functioning, and emotional well-being. Neuro-QOL is targeted for individuals with neurological disorders (e.g., stroke, Parkinson's disease, multiple sclerosis, amyotrophic lateral sclerosis, epilepsy, and muscular dystrophy). Recently funded studies have extended this research to individuals who have had a traumatic injury. Utilizing a grounded theory design, individuals with Traumatic Brain Injury and Spinal Cord Injury discussed areas relevant to their quality of life.

**Participants and Methods:** Three large collaborative grants have provided funding to conduct focus groups with individuals with TBI (N = 7 groups; N=33), SCI (N = 22 groups; N=111), caregivers of individuals with TBI (5 groups; N = 18), and neuropsychologists/rehabilitation clinicians (11 groups; N = 99). Two reviewers coded these qualitative data using NVivo and prepared item pools based upon review of the transcripts that are specific to individuals with TBI and SCI.

**Results:** Item banks were developed for perceived cognitive functioning, functional ability, medical complications (e.g. Pain/fatigue/secondary complications), social/participation, and emotional functioning. PROMIS and Neuro-QOL items were included in the item banks along with new items for issues relevant to individuals with TBI or SCI.

**Conclusions:** These outcome measures have the potential to become standard in clinical trials research. Tailoring them for use in populations of individuals who have had traumatic injury is being supported by

NINDS, NCMRR, NIDRR model system programs, and VA RR&D grants program. New scales will be useful in clinical trials research at NIH, polytrauma research at the VA for veterans returning with TBI from the conflicts in Iraq and Afghanistan, and NIDRR funded rehabilitation research.

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### Cognitive Intervention/Rehabilitation

**L.J. ALTMANN, J. NOCERA, C.J. HASS & C.M. SAPIENZA.** **Exercise Effects on Cognition and Language in Parkinson's Disease: A Case Study.**

**Objective:** Cognitive impairments in Parkinson's disease (PD) often do not respond to pharmacological or surgical intervention. Additionally, language difficulties in PD frequently go untreated. This case study investigated the effects of an aerobic exercise intervention on cognition and language use in an individual with PD. The basis for this study comes from reports of improved cognitive performance in healthy adults due to aerobic exercise.

**Participants and Methods:** The participant was a 66 year old female with idiopathic PD-Stage II diagnosed 11 year ago. Her MMSE score was 30 at time of testing. The participant completed an 8 week exercise intervention involving 20 minutes riding a stationary bicycle 3 times a week. Pre- and post intervention, the participant completed a battery of executive function and working memory tasks, and a 20-item picture description task. Tasks were tested in single and dual task (i.e., while cycling) conditions.

**Results:** Following intervention, performance improved on digit span backward, Stroop color XX and color words, and semantic fluency, although the latter only improved under single task conditions. Quality of picture descriptions improved at posttest. Descriptions were more focused (fewer words per proposition), more grammatical, and more fluent, although fluency only improved in the single task condition. Cycling performance also improved and showed lower dual task effects at post-test.

**Conclusions:** This case study found improved performance in motor, working memory, executive function, and language tasks following an 8-week aerobic exercise intervention. Thus, exercise may prove to be a drug-free intervention for cognitive impairment that can benefit multiple systems in PD.

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**K.D. BRADY, T. GARCIA, K. ALLISON & J. CARNEY.** **Cognitive Changes Following Constraint-Induced Movement Therapy (CIMT) for Children with Hemiparesis.**

**Objective:** CIMT is an innovative intervention for hemiparesis based on Taub, who showed that constraint of the stronger arm in conjunction with intensive, repetitive shaping of movement with the hemiparetic arm restored function to the hemiparetic arm of chronic adult stroke patients. Taub attributed improvement to reduction of learned nonuse. Imaging has documented changes in motor cortex following CIMT, which is now also understood as reflecting experience-based neuroplasticity. We describe the interdisciplinary model of pediatric CIMT implemented at the Kennedy Krieger Institute (KKI), and evaluate anecdotal reports of "collateral" cognitive benefits. We hypothesized that, in addition to motor improvements, participants would demonstrate cognitive gains post-treatment, and further, that the nature of the gains would vary with laterality of the limb stimulated.

**Participants and Methods:** Six children in 2 age groups (4-7 and 11-14 yrs.) attending CIMT "camp" in an outpatient rehabilitation setting at KKI in the summer of 2008 received pre- and post-treatment cognitive assessment of single word receptive (PPVT-4) and/or expressive (EVT-2) language and of visual-spatial problem-solving (TONI-3).

**Results:** All 3 participants in the older group showed post-CIMT increases in language scores, while only the participant who received intensive therapy with the left arm (i.e. stimulation to right hemisphere) showed improved visual-spatial cognitive function. The younger group did not show cognitive changes post-CIMT.

**Conclusions:** Repetitive motor activity can induce cognitive changes that vary depending on laterality of the stimulated limb, possibly due to activation of attention and other mechanisms of neuroplasticity. Neuroplastic benefits of stimulation may generalize beyond the specific cortical target of input. The neuropsychologist has a role on the interdisciplinary CIMT team in harnessing this generalization effect for cognitive rehabilitation.

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**M. DENHAM, J.L. GESS & A.Y. STRINGER. All My Grandchildren: A Case Study of the Remediation of a Category-Specific Naming Deficit Following Temporal Lobe Epilepsy Surgery.**

**Objective:** Studies have demonstrated category-specific dysnomia in temporal lobe epilepsy (TLE) before and after seizure surgery (Seidenberg et al., 2002). Despite this, no treatments for dysnomia have appeared. We present a case in which errorless learning was used to overcome a category specific dysnomia.

**Participants and Methods:** "MG", a 52-year-old female, was status post left temporal lobectomy for TLE. She had a postsurgical dysnomia that included her six grandchildren. Treatment focused on teaching her grandchildren names in response to their pictures. Names were divided into two lists (A and B). The method of vanishing cues, an errorless learning technique, was used for list A, and rote rehearsal was used for B. Retention was assessed after one week.

**Results:** At pretreatment baseline, MG knew none of the list A names and only 1 from list B. Using errorless learning, she successfully learned all List A names and retained them at 1 week follow-up. Using rote rehearsal, she initially learned all List B names, but fell back to baseline after a 10-minute delay. She was retrained on the names using rote rehearsal, but again fell to baseline after 5 minutes. At 1-week follow-up, she retained one list B name.

**Conclusions:** The method of vanishing cues was successful in overcoming a category specific naming deficit with good retention over follow-up. Rote rehearsal was ineffective in overcoming the deficit with delays from 5 minutes to 1-week. Errorless learning techniques could be beneficial with TLE surgery patients, given their frequency of category specific naming deficits.

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**C. GEHL, T.F. BERGQUIST, J.S. SMIGIELSKI, W.S. STOBAUGH, A.W. BROWN & K.S. KENDALL. Neuropsychological and Diagnostic Factors Associated with Outcome after Comprehensive Day Rehabilitation for Acquired Brain Injuries.**

**Objective:** Individuals with acquired brain injuries have participated in comprehensive day rehabilitation at the Mayo Clinic for 20 years. Previously we documented that despite changes in patient population, outcomes remained stable. The current study seeks to assess the relation between patient characteristics, neuropsychological performance, and outcome in this sample.

**Participants and Methods:** Participants were 69 individuals with acquired brain injury (47% traumatic, 14.2% cardiovascular, and 38.8% other brain injuries) who completed the program between 1999 and 2006. Participants were 37.3 years old (sd = 12.1) and 2.3 years post-injury (range 30 days to 33.8 years). Participants completed a comprehensive neuropsychological evaluation at admission. Functioning at home and work was assessed at admission, discharge, and one year following discharge.

**Results:** At admission, 8 percent lived independently and 3 percent were competitively employed. At discharge, 44 percent were living independently and 5 percent were competitively employed. At one year follow-up, 57 percent were living independently and 26 percent of participants were competitively employed. More individuals with non-traumatic injuries required supervision at discharge than those with traumatic injuries ( $\chi = 7.13, p < .05$ ). One year following discharge, individuals with non-traumatic and traumatic injuries showed comparable levels of independence ( $\chi = 3.78, p = .15$ ). Additional analyses will assess the relationship between functional outcomes, neuropsychological functioning, and level of awareness.

**Conclusions:** Overall, improvements in functioning following completion of the program were observed for individuals with acquired brain injury; however, patient variables such as etiology of injury are associated with the rate and level of improvement in functioning.

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**M.D. GRILLI & E.L. GLISKY. "Self-Imagining" Enhances Recognition Memory in Memory-Impaired Individuals.**

**Objective:** The present study investigated the effect of "self-imagining" on recognition in memory-impaired individuals.

**Participants and Methods:** Fourteen patients with neurological damage of mixed etiology (11 TBI) intentionally encoded sentences by deciding whether the sentence had more than 12 syllables or by imagining themselves at the scene described by the sentence. Syllable counting represented baseline structural processing and "self-imagining" represented self-referential processing. Half of the sentences in each task were neutral and half emotional.

**Results:** Despite memory deficits, thirteen of the fourteen individuals benefited from "self-imagining" as evidenced by greater memory for sentences encoded through self-referential processing compared to structural processing. Emotional sentences encoded at a structural level were better recognized than neutral sentences, demonstrating a baseline "emotion enhancement effect" (EEE) in memory-impaired individuals. In contrast, when encoded at a self-referential level of processing, neutral and emotional sentences were equally well remembered. The EEE, but not the SRE, was correlated with a composite measure of general memory function such that those individuals with higher composite memory scores showed a larger EEE. However, self-imagining provided substantial memory benefits for almost all individuals irrespective of their general memory ability.

**Conclusions:** These findings suggest that the self may possess special mnemonic properties and imagining oneself as a participant in an event makes that event very memorable. To our knowledge, this study is the first to demonstrate memory enhancement for a "self-imagining" task in a group of memory-impaired individuals. Self-imagining may prove to be a powerful tool for memory rehabilitation in neurological patients. Correspondence: *Matthew Grilli, Clinical Neuropsychology, University of Arizona, 1800 N Saguaro Place, Tucson, AZ 85745. E-mail: mdgrilli@email.arizona.edu*

**A. JACKSON & R.B. PERNA. Age Effects on Recovery from Acquired Brain Injury.**

**Objective:** Empirical research and the Kennard principle suggest increased age is associated with reduced recovery post acquired brain injury. However specific age group differences in expected rate or extent of recovery are unclear. Our hypothesis was that younger ABI participants would make greater gains (as measured by the MPAI) during neurorehabilitation.

**Participants and Methods:** Participants (N=280) in postacute neurorehabilitation program completed the Mayo-Portland Adaptability Inventory-4, change scores were calculated (admission MPAI-discharge MPAI) for each subscale, and for individual items. The mean age is 39.6 years. Participants were divided into three age groups (20-34, 35-44, 45-55 years).

**Results:** Analyses (ANOVA) showed significant age group differences in alcohol and drug use, and vocational status at discharge. Subjects in the youngest group were more likely to use drugs and alcohol and to be employed when compared to the oldest group. Data did not support age differences between changes on MPAA subscales. Analyses showed that drug use in the youngest group had a significant effect on the Community Participation and Physical Abilities scales, as well as MPAA total.

**Conclusions:** The 20-34 year old participants were more likely to endorse substance use than 45-55 year old participants and were also more likely to be employed upon discharge when compared to both older groups. However, age does not appear to have a significant influence on rehabilitation gains as measured by the MPAA. No history of drug abuse or fully recovered from drug use was associated with greater gains in Community Participation, Physical Ability, and total MPAA change in the youngest group.

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#### **K. JENSEN, L. MARSTRAND, R. FORSLUND & A. HAMARSNES. Case Study: A New Interdisciplinary Approach to Individual Rehabilitation of Youths with Acquired Brain Injury.**

**Objective:** The present case study describes a new way to approach the rehabilitation of a 20-year old man, who at age 19 sustained a traumatic brain injury (TBI) to the left frontal lobe and possible anoxic brain damage following a car accident. At time of injury the patient had an active alcohol- and substance abuse and a previous history of multiple criminal sentences (violence).

Youths with acquired brain injury (ABI) who prior to injury are involved in substance abuse and criminal activity, often make for a complex rehabilitation challenge. They often do not fit in to the current evidence-based cognitive rehabilitation treatment programs. We assume that a high percentage of these youths in Denmark are lost during cognitive rehabilitation, due to the grave barriers placed by the ABI and concurrent issues for the everyday functioning and motivation.

**Participants and Methods:** Case study

**Results:** Case study

**Conclusions:** Attempting to succeed in rehabilitation of these troubled youths, a highly individual matrix-program was created. The matrix consist of an interdisciplinary neurorehabilitation team and an in-the-field support team, organized to continuously adjust to the current goals of neurorehabilitation and challenges experienced by the patient. The present study shows how this approach has led to an increased efficiency of the cognitive rehabilitation due to increased attendance and ability to maintain an alliance over a long period of time. The present study aims to describe the creation and functioning of the rehabilitation-matrix and the demands on staff-training and flexibility.

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#### **K.T. KINGSLEY. Mild Cognitive Impairment and Cognitive Rehabilitation: efficacy of intervention in combination with anticholinergic treatment.**

**Objective:** Pharmacological intervention (anticholinergic drugs) is commonly used to treat mild cognitive impairment. Cognitive remediation for individuals with progressive cognitive and daily living skills decline consists of optimizing the individual's functioning and preserving cognitive abilities. This paper is to present the efficacy of combining a drug intervention with a systematic cognitive training protocol in improving neuropsychological and behavioral symptoms and functional status for individuals with mild cognitive impairment.

**Participants and Methods:** Cognitive rehabilitation encompasses both verbal and nonverbal abilities. In memory training awareness and self-monitoring are targeted. Note-taking and reviewing are encouraged. Strategies include the use of external aides and association / elaboration

- errorless learning are introduced. Attention, language, verbal abstract reasoning and visuo-spatial training are also introduced. Involving caregivers in education and practicing / reinforcing strategies is also addressed. Two clinical cases and their treatment summary are presented (LV, KG)

**Results:** Improvement in MMSE, verbal fluency and verbal abstract reasoning measures.

Improvement in communication and socialization

Improvement in activities of daily living

Improvement in life satisfaction self-reports and decrease in behavioral symptoms (i.e., anxiety, depression).

**Conclusions:** The study supports the idea of potential value-added benefits to combining a systematic program of drug and cognitive training intervention to improve performance on specific cognitive and functional tasks in individuals diagnosed with MCI.

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#### **M.A. LANGILL & B.A. PARMENTER. Remediation Efficacy of the Memory Notebook for Patients with Memory Dysfunction in Multiple Sclerosis.**

**Objective:** Memory impairment is common in patients with multiple sclerosis (MS). This study evaluated the effectiveness of an 8-week memory notebook treatment for MS patients with memory dysfunction. It was hypothesized that patients in the memory notebook training group would demonstrate improved self-reported everyday memory functioning, mood, anxiety, and health-related quality of life compared to the control group who received supportive psychotherapy.

**Participants and Methods:** Fourteen MS outpatients with either a score indicating mild-to-moderate impairment on an objective memory test (i.e., the CVLT-II or the BVMRT-R) or a self-report of a decline in memory were randomly assigned to either the Memory Notebook group (MNG) or the Supportive Psychotherapy control group (CG). Both groups met for 1.5 hours per week over 8 weeks. The outcome measures were between-groups comparison of pre-post change on the Center for Epidemiologic Studies Depression Scale (CES-D), the Everyday Memory Questionnaire (EMQ), the Functional Assessment of Multiple Sclerosis, Version 2 (FAMS-2), and the State Trait Anxiety Inventory (STAI).

**Results:** A greater improvement of depression symptoms was seen for the MNG than the CG ( $p = .04$ ). Non-significant changes for the MNG group only were seen in clinically therapeutic directions on all other measures.

**Conclusions:** This trial supports the efficacy of memory notebook training for distress reduction in MS. More research is needed regarding the effectiveness of this remediation tool for memory abilities in this population.

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#### **K. LEISER, A. KAUGARS, A. HEFFELFINGER, J. KOOP & E. BIRD. The Parent-Child Relationship and Cognitive Outcome in Preschoolers with a Neurological Insult.**

**Objective:** The purpose of this study is to understand how the parent-child relationship contributes to outcome in preschoolers who are neurologically compromised as previous studies have demonstrated substantial variation in outcome in spite of injury severity.

**Participants and Methods:** Twenty-six children ranging from 2 to 5 years of age with a neurological insult or disease and their primary caregiver participated in a play interaction as part of an outpatient pediatric neuropsychology clinic visit during which children's cognitive functioning was also assessed. Research assistants trained to an established reliability standard coded the play interaction to assess specific elements of

caregiver involvement and parent-child relationship quality (Supportiveness; Intrusiveness; Hostility; Quality of Instruction; Quality of Relationship; Maternal Confidence; Dissolution of Boundaries). Psychometrists administered measures of cognitive functioning (DAS-II, WPPSI-III, MULLEN).

**Results:** Preliminary analyses from this ongoing study revealed a significant relationship between the Quality of Relationship code (i.e., mutual engagement and reciprocity in the parent-child dyad) and children's verbal abilities as assessed using the DAS-II or WPPSI-III ( $r = .50, p < .05$ ). Significant relationships were not found among parent-child relationship variables and scores reflecting nonverbal abilities or overall cognitive functioning. Future analyses will control for injury severity using data from medical records and consider additional family characteristics.

**Conclusions:** Contingent responsiveness in the relationship between parent and child with a neurological insult is related to verbal performance ability in preschool children suggesting that interaction therapies may be helpful for improving verbal skills in very young children. Correspondence: *Kara Leiser, M.S., Psychology, Marquette University, 2250 S. Plymouth Rd., Apt. 301, Minnetonka, MN 55305. E-mail: Kara.Lindstedt@marquette.edu*

#### **B. LORENZEN & L.L. MURRAY. Integrating Physical Fitness Training into Traditional Speech-Language Treatment.**

**Objective:** There has been growing interest in and positive research on the connection between physical fitness and exercise, and cognition in a variety of populations, including healthy aging and patient populations (e.g., Laurin et al., 2001; Prakash et al., 2007). Thus, some initial patient research suggests that alternative interventions that combine cognitive and fitness training may represent a viable rehabilitation option. Nominal exploration exists, however, of if and how exercise might enhance communication abilities, particularly in patient populations receiving speech-language treatment (ST).

**Participants and Methods:** We created a combined physical fitness and ST therapy program for an individual with a complex medical history of traumatic brain injury, stroke, multiple sclerosis, and poor physical fitness. Each session consisted of an initial 15 minutes of physical training followed by 60 minutes of ST. A personal trainer conducted the fitness training, which included functional exercises to improve performance of daily living activities. ST targeted breath support, speech intelligibility, and expressive output using traditional therapy activities. Data from standardized assessments and training tasks were collected.

**Results:** Our client demonstrated improvement on speech-language goals, increasing breath support and oral and written output, and reducing word omissions. He also provided positive feedback regarding the inclusion of the physical activities.

**Conclusions:** Our case study examined the hypothesis that combining low-intensity fitness training with ST would enhance speech-language outcomes in a client with language and cognitive impairments. Findings were encouraging, documenting positive speech-language outcomes. This suggests the need to further this line of transdisciplinary treatment research.

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#### **K. MANNING, M.T. SCHULTHEIS, R. MITURA, D. KLIMCHUCK, L. BOYLE, D. NEYENS, J. ANG, D. SALVUCCI, C. MONAGLE & L. SIMONE. Virtual Reality Driving: Can new measures help inform driving capacity in TBI?**

**Objective:** To demonstrate driving performance measures of a virtual reality driving simulator (VRDS) at varying levels of traumatic brain injury (TBI) impairment.

**Participants and Methods:** Performance of two matched pairs of TBI (1 TBI-mild, 1 TBI-mod/severe) and healthy controls (HC) was examined. All participants drove a 25-minute route using the VRDS. The

route included 1) varying driving environments (e.g., residential, highway), 2) driving challenges (e.g., pedestrian crossing) and 3) automatically recorded driving performance variables. Basic driving included speed, steering and pedal use and was examined in a residential and highway environment. Complex driving included traffic light responses and navigation.

**Results:** Comparison of basic driving measures did not reveal differences within and between pairs. By contrast, complex driving revealed greater driving errors in the mod/severe TBI, as compared to HC and the mild-TBI. This included errors in speeding (i.e., 26 mph over the posted speed limit) and errors in response to traffic light (i.e., ran 1/3 traffic lights). Evaluation of departing speed (defined as first 5 sec.) from a complete stop (i.e., red light) revealed that the mod/severe TBI speed (0-22mph) was twice as fast as mild-TBI (0-11mph) and greater than both HC (0-15, 0-16mph).

**Conclusions:** VRDS offers unique driving performance measures not currently available. These may prove to be a sensitive and valid measure of driving ability in individuals with TBI. Data collection continues and additional analyses are planned.

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#### **K. MILLER, P. SIDDARTH, E. O'TOOLE, J. KIM & G. SMALL. A Computer Fitness System for Older Adults: Evaluating the Effects of [M]POWER® by Dakim.**

**Objective:** Approximately 40% of older adults experience age-related memory decline, but lifestyle choices, including cognitive stimulation, may contribute to brain health. The purpose of the study was to determine if daily use of a computer-based program, the [m]Power® Cognitive Fitness System by Dakim, Inc. improved memory in older adults.

**Participants and Methods:** Participants (N=22) were recruited from a local retirement community. The intervention consisted of 30-minute individual sessions completed five times a week; control group watched educational videos. Thirteen participants completed the intervention (mean age was 72 years old, 14 years of education), while 9 participants were in the control group (mean age was 74 years old, 15 years of education). Standard neuropsychological testing was completed.

**Results:** Using a repeated measures ANOVA (n=22), there was no statistically significant improvement in objective memory scores in the [m]Power group compared to the control group; however, there was a trend of the intervention group to perform better on a task of working memory ( $F(1,20) = 3.50, p=.08$ ), as measured by Digits Backward when compared to the control group. Analyses indicated that those [m]Power participants who achieved a superior level of competence, as indicated by completing a higher level of program, improved on formal measures of both immediate and delayed measures of memory compared to those participants who performed at a lower level on [m]Power.

**Conclusions:** This study demonstrated some trends of improvement for those utilizing the computer-based program [m]Power, including possibly better working memory, and immediate and delayed recall for those who can complete higher levels of the program. Findings may have been limited due to the sample size of this study.

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#### **J. MINGA & K. LUNDGREN. An Analysis of Discourse Production and Working Memory in One Individual with Right Hemisphere Brain Damage (RBD).**

**Objective:** The purpose of this pilot study was to investigate the impact of a structured cognitive-linguistic training program on discourse production and working memory.

**Participants and Methods:** A 60-year-old man, six years post middle cerebral artery stroke, participation in a structured cognitive-linguistic intervention, The Metaphor Training Program (Lundgren et al., 2006).

The production of discourse parameters including question, elaboration, comment, continuer, novel information, clarification, response to question and problem utterances were assessed pre- and post-training. In addition, a working memory assessment was given before and after training as part of a larger cognitive-linguistic battery.

**Results:** Preliminary results indicate an increase in contribution to conversation and improved performance on a measure of working memory following structured training. Specifically, this patient produced more elaborations and comments in conversation post-training as compared to pre-training performance. In addition, the patient demonstrated improved performance on a test of working memory following the intervention.

**Conclusions:** Discourse deficits are often observed in adults with RBD. Theoretical foundations for communication deficits in RBD are divergent. An examination of one aspect of cognition, working memory, may begin to provide insight into underlying factors contributing to the communication deficits observed in individuals with RBD and may provide a means for remediation. This study suggests that a structured cognitive-linguistic intervention may carry over into untrained language tasks (i.e. conversation) and result in improvement in untargeted cognitive performance (i.e. working memory).

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#### **R. PERNA & A. JACKSON. Acquired Brain Injury: Rehabilitation Gains and Return to Work.**

**Objective:** A goal of neurorehabilitation is preparing people for community reintegration and return to employment. It is not always clear which rehabilitation gains are most predictive of return to work. Our hypothesis is that improvements in adaptability (as measured by the MPAL) would improve employability.

**Participants and Methods:** Retrospectively, 412 participants with acquired brain injuries (women= 256, men= 156) with a mean age of 41.4, in a neurorehabilitation program completed the Mayo-Portland Adaptability Inventory-4 and change scores were calculated (admission MPAL-discharge MPAL) for each subscale (Physical/Cognitive ability, Community Participation, Psychosocial Adjustment). All participants work status was rated (0= FT, 1=PT, 2=PT/FT with supports, 3= unemployed) on admission and at discharge.

**Results:** Individuals with different employment status had significantly different rehab gains as measured by the MPAL. Those with the greatest improvement in MPAL Total score [ $F(403, 3) = 15.9, p < .001$ ], Community Participation subscale [ $F(339, 3) = 11.1, p < .001$ ], and Psychological Adjustment scale [ $F(398, 3) = 6.74, p < .001$ ] were significantly more likely to be working full-time at discharge. Analyses (ANOVA) found that higher education and lower age results in improved employability.

**Conclusions:** As a result of neurorehabilitation, there is a significant improvement in employment status, with more people employed and for greater number of hours. Improvement on the MPAL indicated an increased likelihood of employment following neurorehabilitation. Specifically, improved physical ability, psychological adjustment, and community participation all appear to contribute to improved employment status.

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#### **J.H. SANZ, L. WACHTEL, F. PIDCOCK, J. YAP, J. REESMAN & B.S. SLOMINE. Treatment of Delirium with Aripiprazole Following Posterior Fossa Tumor Resection: A Case Study.**

**Objective:** Cerebellar Cognitive Affective Syndrome (CCAS) has been described as a constellation of cognitive deficits and emotional dysregulation that occurs following focal damage to the cerebellum. We describe a patient with CCAS and delirium who was treated with aripiprazole.

**Participants and Methods:** A.D. is an 18-year old woman who experienced altered mental status, visual hallucinations, and severe agita-

tion that began two days post resection of a posterior fossa tumor. Neurobehavioral examination, conducted two weeks after resection and directly after transfer to an inpatient rehabilitation setting, revealed severe executive dysfunction (perseveration, impulsivity, decreased initiation of voluntary movement), emotional lability, agitation, disorientation, and impaired memory. While neurobehavioral status was partially consistent with CCAS (including emotional lability and executive dysfunction), disorientation and severe memory impairment were more consistent with delirium. Given prior reports indicating its efficacy in treating delirium of various etiologies, aripiprazole was started five weeks post resection.

**Results:** Within days after starting aripiprazole, marked improvements in mental status were noted including improvements in orientation, memory, and executive functioning, and a shift to prominently bright (but restricted) affect. Mental status continued to slowly improve over the remainder of the rehabilitation admission. Aripiprazole was gradually weaned and discontinued five months after tumor resection. A neuropsychological evaluation conducted six months post-resection indicated improvements in most domains, but continued deficits in areas of executive functioning (working memory, planning, and judgment), visuospatial and visuoconstructional skills, and visual memory.

**Conclusions:** This case illustrates that aripiprazole may be therapeutically useful in a neurorehabilitation setting, particularly for the treatment of agitation and delirium in CCAS.

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#### **M. SHIBASAKI. Cognitive Rehabilitation of Activation in a Patient with a Frontal Lobe Lesion.**

**Objective:** Activation regulating function that generates and maintains actions or mental processes is frequently impaired by frontal lobe lesions. This study was performed to examine the effectiveness of cognitive rehabilitation for the activation deficit in a patient with a frontal lobe lesion, using a single-case experimental design.

**Participants and Methods:** A 35-year-old right-handed male patient who exhibited severe activation problems following a right frontal lobe lesion received two training programs. Both programs consisted of one assessment task and two training tasks, one of which was directed at improving spontaneous movement of attention and eyes, while the other was directed at improving patient's responsiveness to target stimuli. All assessment and training tasks were visual search tasks, but go tasks were used in training 1 and go/no-go tasks were used in training 2. The target behaviors of both training programs were reductions of miss rates and decreases in reaction times to the target stimuli in the assessment tasks.

**Results:** In training 1 and 2, the patient demonstrated significant reductions of miss rates, while there were no significant differences in reaction times between the baseline and training sessions. In addition, generalization of the training effect was found in other frontal lobe tasks.

**Conclusions:** Although no clear training effect was found with respect to response speed, patient's responsiveness itself was improved by cognitive rehabilitation intervention for the activation deficit. Moreover, the improvement of such function had a positive influence on other frontal lobe functions.

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#### **L. SZE, A.S. CHAN & D. SHI. Dejian Mind-Body Intervention Improves Self Control Ability of an Adolescent with Asperger's Disorder.**

**Objective:** The present study aims to provide preliminary evidence on the effectiveness of a traditional Chinese mind-body intervention, namely the Dejian Mind-Body Intervention (DMBI), in improving self-control ability of a case diagnosed with Asperger's disorder.

**Participants and Methods:** A sixteen-year-old teenage girl (TK), as reported by her mother to have frequent temper outbursts, perseverative speech, and significantly impaired social relationships, was treated with the DMBI for three months on weekly and later bi-weekly basis.

**Results:** Instant intervention effect was noted with significant reduction in temper tantrums and repetitive behaviors, and faster self-calming process observed in TK after the first week of intervention. The effect was able to sustain throughout the three-month intervention period. Additional positive changes in problem-solving and psychosocial functioning were also observed.

**Conclusions:** The present encouraging findings have provided preliminary efficacious support for the traditional Chinese mind-body intervention on improving brain functions and promoting psychological well-being.

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#### A. TREBLE, D. REWILAK, D. JOVANOVSKI & K.K. ZAKZANIS. Effectiveness and Generalization of a Cognitive Rehabilitation Program for Executive Dysfunction.

**Objective:** The executive functions are vulnerable to numerous types of brain injury and psychiatric conditions. Despite the prevalence of executive dysfunction, there have been few rehabilitative interventions targeting these impairments. The objectives of the present study were to investigate the effectiveness and generalization of a cognitive rehabilitation program for participants experiencing executive dysfunction in their everyday lives.

**Participants and Methods:** Three brain-injured individuals and one individual with a psychiatric condition underwent 7-week Goal Management Training (GMT). Through the use of presentations, discussions, exercises, and homework assignments, the main goals of GMT are to assist participants in developing awareness of attentional control lapses and to provide strategies to overcome these difficulties. Participants' pre- and post-intervention performances were compared on a brief battery of standardized neuropsychological tests, two behavioural rating scales of everyday executive deficits, and a novel virtual reality (VR) test designed to simulate real world behavior.

**Results:** The most reliable finding across participants was improved performance on the VR test. In addition, all participants endorsed more frequent everyday dysexecutive behaviors after GMT, whereas, their significant others generally reported fewer instances of such behaviors. Neuropsychological test results were mixed.

**Conclusions:** The results provide preliminary evidence for the effectiveness and generalization of GMT to everyday functioning in individuals with executive impairment. Findings suggest that participants became more aware of their executive errors and concurrently reduced the frequency of these behaviors. Future research involving more rigorous experimental control should be pursued in order to provide more conclusive results.

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#### G. TREMONT, J.D. DAVIS, B.M. BECKER & B.C. BOCK. Effects of Yoga on Cognitive Functioning in Older Adults with Memory Complaints: Preliminary Findings.

**Objective:** Yoga is a physical practice emphasizing breath control, stress reduction, and mindfulness. Yoga has proven physical health benefits in older adults, but its impact on memory and cognition is unknown. The goal of this study was to determine feasibility and preliminary efficacy of a yoga intervention for older adults with memory complaints and/or mild cognitive impairment (MCI).

**Participants and Methods:** Participants were 10 older adults (5 males, 5 females; M age = 69, SD = 7.06) who were concerned about their memory. Six of the 10 participants were diagnosed as MCI by a

neuropsychologist and/or neurologist after comprehensive workup (3 males, 3 females; M age = 73, SD = 5.93). All participants underwent baseline cognitive assessment and then participated in twice-weekly, 1-hour yoga classes for 8 weeks. Repeat assessments were conducted immediately following the last class. Yoga classes consisted of seated meditation, breathing exercises, and standing/seated postures, and participants were encouraged to use supports (chairs, blocks, and straps).

**Results:** Results for all participants showed statistically significant post-treatment improvement in Hopkins Verbal Learning Test- Revised delayed recall (Baseline M = 6.0, SD = 2.94; Post-treatment M = 7.5, SD = 2.64,  $p = .034$ ). Patients with MCI also exhibited statistically significant post-treatment improvement on the HVLTR delayed recall (Baseline M = 4.33, SD = 2.58; Post-treatment M = 6.33, SD = 2.34,  $p = .033$ ).

**Conclusions:** These findings provide preliminary evidence that a short-term yoga intervention may improve cognitive functioning in older adults with memory complaints and MCI.

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#### D.T. WOODS, C. CATROPPA, V. ANDERSON, J. MATTHEWS, G. REBECCA & P. BARNETT. Preliminary Treatment Acceptability of a Family-Centred Intervention for Parents of Children with an Acquired Brain Injury (ABI) – Pilot Study.

**Objective:** Children with ABI are at significant risk of developing serious behavioural problems which are a source of distress for parents. Parental distress compromises parenting abilities, with adverse effects for the child with ABI. Limited evaluation of the effectiveness of interventions to improve parents' ability to manage behavioural sequelae following ABI has been conducted. This project involves investigating the applicability of Signposts for Building Better Behaviour intervention program, originally developed for children with an intellectual disability, in assisting parents and families to reduce distress, and better manage difficult behaviours of children with an ABI.

**Participants and Methods:** Participants were 48 parents and families of children with mild, moderate or severe ABI. Parents completed 8-modules of the Signposts program over 3-months via group or telephone delivery.

**Results:** Parents reported significant reductions on the Depression Anxiety Stress Scale (DASS), significant reductions in child behaviour problems as measured by the Child Behaviour Checklist (CBCL), and families reported a significant decrease on the Family Burden of Injury (FBI) scale. Parents agreed that parenting skills taught were appropriate and useful for an ABI cohort.

**Conclusions:** Preliminary efficacy for the Signposts program has been established and is now being evaluated in a larger randomised-control trial. Family-centred interventions after paediatric ABI are ensuring the continued evolution of best practices and policies in the rehabilitative process.

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#### K. ZAKZANIS, Z. CAMPBELL & D. JOVANOVSKI. A Multimodal Approach to Early Interventions in Mild Cognitive Impairment: A Meta-Analysis of the Literature.

**Objective:** Elderly individuals with Mild Cognitive Impairment (MCI) represent a particularly vulnerable subpopulation of older adults. This meta-analytic review analyzed the available research literature employing multimodal approaches to early intervention. These approaches encompassed education on memory, relaxation skills training, mnemonic strategies, cognitive restructuring to change beliefs about memory control, training in specific memory skills, training on coping with environmental stressors due to cognitive decline, and training for everyday problem solving in the functional domain.



**Participants and Methods:** In total five studies meeting strict inclusion criteria contributed data to the meta-analysis, comprising a total of 2,351 MCI cases and 845 normal controls.

**Results:** Overall results are provided for each domain - cognitive, functional, and behavioral - for each time period: post treatment-baseline, follow-up-baseline, follow-up-post treatment. In the cognitive domain, the weighted mean effect size for post treatment-baseline (p-b) was  $d=0.825$  and for follow-up-baseline (f-b),  $d=0.489$ . For the behavioral domain, p-b was  $d=1.231$ , and f-p was  $d=0.398$ . In summary, multimodal treatment strategies showed a large significant effect for both cognitive and behavioral domains. The functional domain did not demonstrate any such improvement but rather demonstrated the stability of change from baseline scores over time, where p-b had an effect size of  $d=0.303$ , and f-p,  $d=0.338$ .

**Conclusions:** Accordingly, the results from this review indicate that a multimodal treatment approach to early MCI is effective in improving cognition and behavior for at least three months post status and may delay the progression of Alzheimer's disease for up to two years.

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## Forensic Neuropsychology

**D. HOOFIEN, O. HEGEDISH & N. BAR-LEV. Compensation Seeking, Socio-Economic Status And Severity Of Injury As Predictors Of Effort In Neuropsychological Evaluation: A WMT Study.**

**Objective:** Suboptimal effort during neuropsychological assessment is a significant obstacle in verifying plaintiffs' complaints during law of torts procedures. The Word Memory Test (WMT, Green, 2003) is one of the most commonly used symptom validity tests designed to evaluate this tendency. The goal of the present study was to examine the concurrent validity of the Hebrew version of the WMT by examining the associations between effort and other potentially relevant socio-economic and injury-related variables.

**Participants and Methods:** Sixty patients with acquired brain injuries (13 females) performed the Hebrew version of the WMT. Mean years of age and years since the injury were 35.4 (SD 11.4) and 4.2 (SD 5.63) respectively. At the time of the study, 55% of the patients were actively involved in compensation seeking (CS), while the remaining 42% had already reached a settlement.

**Results:** Of the 60 patients, 38 (63%) passed WMT cutoff scores (82.5% correct responses) and the remaining 22 (37%) failed to do so. Comparisons between these two groups revealed that failure in WMT was significantly predicted by compensation seeking. Ninety one percent of those who failed the test were CS, as compared to 38% of those who passed the test ( $\chi^2=15.1$ ,  $p<0.001$ ). Other statistically significant predictors of low effort were: low pre-morbid SES, mild brain injury, negative findings in brain scans and no post-injury neurosurgical intervention.

**Conclusions:** Failure to pass WMT cutoff scores is significantly associated with CS, low SES and lack of hard-core evidence of brain injury, thus asserting the concurrent validity of the WMT.

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## Other

**D. BADENES, L. CASAS, J. CEJUDO, O. GARCIA, M. SUÁREZ, N. CALZADO & M. AGUILAR. PARKINSON DISEASE AND DRIVING.**

**Objective:** a) To study if the assessment tools used for driver's licence renewal are appropriate to detect impairment in cognitive related driver's abilities PD; b) to determine which neuropsychological tests may be useful to make decisions on driving capacity in PD c) to describe the relationship between this neuropsychological performance and driving testing.

**Participants and Methods:** 87 people were included: 46 PD and 41 healthy controls (HC). PD severity was assessed by Hoehn & Yahr (YH). Cognitive functioning was evaluated by RBANS, Z-Cog, TMT, Blocks. Routine Driving capacity assessment involved by ASDE and UFOV test to assess general capacity and risk for accidentability. Concurrent psychiatric comorbidity as depressive and anxiety related symptoms were evaluated by BDI and BAI. Sleep disturbances were evaluated by Epworth Sleepiness Scale

**Results:** In the ASDE results PD showed worse results in motor coordination tasks, sustained attention and resistance to monotony compared to HC. UFOV results according to PD severity showed a 32% of patients at HY2, obtaining 4 and 5 (theoretical risk), whereas all the patients at HY1, were suitable for driving. In PD neuropsychological profile showed lower punctuations in attention, visuospatial and memory tests, compared to HC. High anxiety (somatic and physical). They do not differ in depression symptomatology, but showed a major trend to diurnal sleepiness. Driving test correlate with: visuospatial capacities, attention, Blocks but not with anxiety, depression and sleepiness.

**Conclusions:** The determinant factors for driving in PD were cognitive deficits in visuospatial capacities, attention, block design, and the severity of the disease were determinant for risk of accidentability

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**M.T. BARISA, T.A. KAIP, M.D. THOMAS & K. OSBORN. Neurosarcoidosis: A Neuropsychological Case Study.**

**Objective:** Sarcoidosis is a multisystem immune system disorder of unknown etiology characterized by granulomas typically presenting in the lymphatic system and lungs. In rare cases the central nervous system is involved (neurosarcoidosis). This occurs in few patients with sarcoidosis (approximately 5%). Isolated neurosarcoidosis without systemic disease is particularly rare (approximately 1%). The granulomas occur around the stalk of the pituitary with diabetes insipidus or in the cerebellum with ataxia. This poster will present an overview of neurosarcoidosis with specific emphasis on a singularly involved lesion in the brain (as opposed to the more common systemic lesions) through the case of a young male.

**Participants and Methods:** This case presentation includes basic demographic information and results from the medical diagnostic work-up, neuroradiological examination, and neuropsychological test data of a 29 year old African American male.

**Results:** The patient initially presented with a history of seizures. Initial CT was normal. His seizures continued and further imaging studies were positive for a mass lesion diagnosed as a falxotential meningioma. Craniotomy for removal of the mass was initiated, but deemed medically contraindicated due to high intracranial pressure. He was subsequently referred to oncology and underwent a lesion biopsy resulting in a diagnosis of neurosarcoidosis. Results from a comprehensive neuropsychological battery indicated diffuse pattern of impairments with bilateral superior quadrant visual field loss.

**Conclusions:** Detailed medical, neurologic, and neuropsychological results will be presented. The case study is significant as primary neurosarcoidosis is infrequently reported in the literature but important to recognize in clinical practice.

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**E. CACCAPPOLO, R. ALCALAY, L. CLARK, H. MEJIA-SANTANA, H. LOUIS, C. COMELLA, A. COLCHER, D. JENNINGS, M. NANCE, S. BRESSMAN, W. SCOTT, C. TANNER, M. TANG, H. ANDREWS, C. WATERS, S. FAHN, L. ROSADO, B. ROSS, L. COTE, S. FRUCHT, B. FORD, M. REZAK, K. NOVAK & K. MARDER. Neuropsychological Profile of Subjects with Early Onset Parkinson's Disease, with and without Parkin Gene Mutation.**

**Objective:** To investigate the role of parkin mutations on neuropsychological performance of subjects with Early onset Parkinson's disease (EOPD), defined as age at onset (AAO) of PD < 50.

**Participants and Methods:** Neuropsychological test scores were collected on 77 non-demented PD subjects (AAO<50, MSE>24). Subjects were divided into 3 groups based on parkin gene mutation: non-carriers (n=25); heterozygotes (n=28); and homozygotes/compound heterozygotes combined (n=24). Two analyses were conducted: 1) standardized scores of non-carriers were examined to identify the cognitive performance in subjects without parkin mutations; 2) normative-based test scores were compared across gene mutation groups to assess for cognitive differences.

**Results:** Non-carriers performed within normal limits across tests, but exhibited low average executive functioning and slowed psychomotor speed, i.e. TMT-A=32nd %ile, TMT-B=35th %ile, Stroop C-W=29th %ile. Memory tests were notable for low average encoding (CVLT Trial 1-5=24th %ile) in light of average recall (free recall short delay=40th %ile; free recall long delay=44th %ile) and recognition (Recognition Hits=39th %ile). Finger tapping was impaired bilaterally (Right & Left=<1st %ile).

Mean age (51.3) and education (15.1) did not differ across gene-status groups. Homozygotes/compound heterozygotes scored lower than non-carriers on Visual Reproduction I ( $p<.04$ ) and II ( $p<.04$ ), and the number of CVLT-II intrusion errors ( $p<.01$ ) after controlling for the effect of disease duration.

**Conclusions:** EOPD subjects without parkin mutations exhibit similar neuropsychological functioning to previously published profiles of PD subjects, including frontal-subcortical weakness. Homozygous/compound heterozygous mutation carriers scored lower on tests of executive functioning and nonverbal memory, suggesting that mutations may predispose to cognitive dysfunction.

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#### H. COHEN, H. FORGET, I. BOURDEAU, S. CHRISTOPOULOS & L. ANDRÉ. NEUROPSYCHOLOGICAL PERFORMANCE IN CUSHING'S SYNDROME: 3-YEAR FOLLOW-UP STUDY CORRECTION OF HYPERCORTISOLISM.

**Objective:** Chronic exposure to elevated glucocorticoids (GC) levels in Cushing's syndrome (CS) is associated with deficits in cognitive function and in emotion. We previously showed that CS patients scored significantly lower than controls on several aspects of cognition, such as reasoning and concept formation, verbal and language performance as well as in nonverbal aspect of memory and in attention tasks (JINS (2000) 20) and that correction of hypercortisolism is not necessarily correlated with short-term improvement in cognitive performances (Psychoneuroendocrinology 27 (2002) 367). In the present study, we examined the long-term outcome in patients treated for CS by assessing whether the detrimental effects of an excess of GC hormones on cognition can be reversed three years after corrective surgery.

**Participants and Methods:** Eighteen patients with endogenous CS were recruited before surgical treatment. A battery of neuropsychological tests and the Beck Depression Inventory (BDI) were administered pre-treatment and at 12, 24 and 36 months post-treatment.

**Results:** Repeated-measures analyses of covariance, controlling for scores of depression, were used. One year after successful treatment, a significant improvement in BDI was noted, showing the beneficial effect of adrenal steroids suppression on depressive disorder symptoms. However, the results showed no amelioration in selective attention and immediate visual recall tasks and in executive functions (interference, concept formation and flexibility) 36 months after the corrective surgery.

**Conclusions:** The results of this study indicate that CS has, even when biochemically stable, long-term adverse effects on cognitive functioning. We hypothesize that this is related to irreversible changes in central neural function.

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#### P.J. QUARTANA, M. DUX, R. MINTZ, E. PRENSKY, L. RENTERIA, A. AHLUWALIA & N. PLISKIN. Clinical Neuropsychological Test Performance in Chronic Pain: Do Psychiatric History and Sub-optimal Effort Underlie Observed Cognitive Deficits?

**Objective:** Neuropsychological deficits have been reported in chronic pain, with profiles similar to those seen in TBI. Unlike TBI, most chronic pain conditions are not due to any direct neurological insult. Some have speculated that poor effort, medication side effects and/or psychiatric history (e.g., depression) account for the deficits observed in chronic pain. We examined neuropsychological performance between mild/moderate TBI and chronic pain patients who passed objective tests of effort.

**Participants and Methods:** Sixty-six mild/moderate TBI patients with no psychiatric or other neurological history and 46 chronic pain patients without (CP-Stable) and 33 with a psychiatric or neurological history (CP-Distressed) underwent a comprehensive clinical neuropsychological test battery. A high proportion of participants in both pain groups were using narcotics compared to only 4% of TBI participants.

**Results:** Clinically significant deficits were quantified as z-score  $\leq -1.0$ . On tests of verbal memory, 7.1% of CP-Clean patients had deficits, whereas 39.3% of CP-Distressed and 53.6% of TBI patients evidenced deficits ( $p<.01$ ). In the areas of psychomotor speed, divided attention and bilateral fine motor speed and dexterity, a consistent pattern was observed whereby a lower proportion of CP-Stable (M=6.1%) and CP-Distressed (M=12.2%) patients evidenced deficits than the TBI group (M=81.5%; all  $p$ 's  $\leq .07$ ). There were no group differences in basic attention ( $p = .42$ ).

**Conclusions:** Chronic pain patients who demonstrated adequate effort on clinical neuropsychological tests, irrespective of their psychiatric history and despite usage of narcotic analgesics, exhibited little clinically significant neuropsychological impairment, particularly when examined in comparison to those with TBI.

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#### D.M. FITZGERALD-DEJEAN & S.S. RUBIN. Investigation of the Effect of Modified Tai Chi Training as a Component of a Multidisciplinary, Intensive Treatment Program for Individuals with Chronic Brain Damage.

**Objective:** While treatment efficacy for physical, psychosocial, cognitive, and communication impairments for the chronically brain damaged has been aggressively studied, little research has examined multidisciplinary treatment. This investigation studied the physical impact of modified Tai Chi training on participants engaged in a 35 hour a week, 6 week, intensive, multidisciplinary treatment program also including communication disorders treatment, psychological support, and social/educational activities.

**Participants and Methods:** The 6 individuals with chronic brain injury who attended the intensive program were randomly assigned to two modified Tai Chi treatment groups administered 1 hour, 3 times weekly for either the first or last 3 weeks of the program. Additionally, 6 participants with chronic brain damage completed all assessments but received no modified Tai Chi.

**Results:** A one-sample t-test used to compare the difference in performance between the 3 week period groups with Tai Chi administered or withheld for the 6 participants found a significant difference on the Timed, Up and Go [TUG;  $t(5) = -3.896, p = .006$ ] following modified Tai Chi. However, comparison of the mean scores for the 2 periods using an independent-samples t-test found TUG performance only approached significance [ $t(6.9) = -15.590, p = .0785$ ]. Then, a one-way repeated measures ANOVA comparing the 2 treatment groups and the control group suggested that the first 3 week treatment group performed significantly different on the Six Minute Walk Test (6MWT) following modified Tai Chi [ $F(2) = 5.074, p = .043, \text{partial } \eta^2 = .592$ ]. However, at 10 week follow-up, these gains were not sustained.

**Conclusions:** Replication should expand sample, lengthen intensity and use ABA design. Theoretical and clinical findings will be discussed.

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**J. GRACE, M.A. AMICK, S. QUELLER, J.C. STOUT & J.H. FRIEDMAN. Impact of a cholinesterase inhibitor on sequential and reversal learning in Parkinson's disease.**

**Objective:** We sought to examine the dopamine-acetylcholine balance in Parkinson's disease (PD) by boosting the cholinergic system with the cholinesterase inhibitor, galantamine. We examined frontal systems functioning with two tasks: Serial Reaction Time (SRT) and Probabilistic Reversal Learning (PR). SRT has been associated with the dorsolateral prefrontal cortex (DLPFC) whereas PR has been associated with orbitofrontal cortex-ventral striatal circuitry (OFC). PR performance also is sensitive to dopamine (DA) "overdose" in PD. That is, in the early stages of PD, DA is more depleted in DLPFC compared to relatively spared OFC. Impaired performance on PR is found in PD treated with DA due to DA "overdose" of the spared OFC. We hypothesized that treatment with galantamine may improve cognition mediated by the DLPFC, but cognition mediated by OF areas may not respond to treatment due to DA overdose.

**Participants and Methods:** PD patients were comparable in age, education, gender, MMSE and disease severity (UPDRS). PD patients were on stable doses of anti-PD medications. Nineteen PD patients on a therapeutic dose of galantamine treatment and 21 assigned to placebo were compared on computer administered PR and SRT task performances.

**Results:** Patients on galantamine showed better sequence learning ( $p=.036$ ) on SRT compared to placebo. PR performance did not differ between groups.

**Conclusions:** Galantamine appears to enhance DLPFC functioning as measured by sequence learning but did not remediate the DA overdose effect upon OFC functioning. This suggests cholinesterase inhibitors may impact frontal areas differentially in interaction with levels of dopamine depletion.

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**R.C. HILSABECK, G.M. ANSTEAD, A.L. WEBB, P. INGMUNDSON, Z. QIONG, A. HOYUMPA, A. DEMATATIS, K. MAJOR, G. HUTCHINSON, E. MATA-GALAN, O. ALI, I. POY, S. LEE, A.M. CASAS, M. JOVEL, R.V. STEIN, S.M. JOHNSON, S. GARCIA & S.L. STERN. Higher Levels of Serum Cytokines are Associated with Poorer Cognitive Functioning in Patients with Chronic Hepatitis C.**

**Objective:** The etiology of cognitive dysfunction in persons with chronic hepatitis C (CHC) infection is unknown. Among the possibilities is prolonged elevation of serum levels of cytokines, such as interferon-alpha (IFN- $\alpha$ ), interleukin-6 (IL-6), and tumor necrosis factor-alpha (TNF- $\alpha$ ). The purpose of the current study was to investigate the relationship between serum levels of these cytokines and cognitive functioning in patients with CHC.

**Participants and Methods:** Participants were 78 veterans with CHC who underwent cognitive testing with the Automated Neuropsychological Assessment Metrics (ANAM) and measurement of serum cytokine levels by ELISA prior to beginning antiviral therapy with pegylated IFN- $\alpha$  and ribavirin. Fifty-three of these participants then underwent the same procedures after 4 weeks of treatment.

**Results:** At baseline, a significant correlation was found between higher IL-6 and poorer working memory. However, when considering only patients with detectable levels of IFN- $\alpha$  ( $N=17$ ), moderate to strong correlations emerged between higher levels of IL-6 and poorer information processing and working memory and between higher levels of TNF- $\alpha$  and poorer spatial processing and memory. After 4 weeks of IFN- $\alpha$  therapy, significant correlations were found between higher levels of IL-6 and TNF- $\alpha$  and poorer information processing and working memory.

**Conclusions:** The results suggest that higher levels of the cytokines IL-6, TNF- $\alpha$ , and IFN- $\alpha$  in serum are associated with poorer neurocognitive performances in patients with CHC after 4 weeks of therapy with pegylated IFN- $\alpha$  and ribavirin. The findings also suggest that cognitive dysfunction is not related to IFN- $\alpha$  itself but to the resulting cascade of cytokines it induces.

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**K.F. HOTH, A. POPPAS, K.E. ELLISON, R.H. PAUL, A. SOKOBIN & R.A. COHEN. Improvements in Neuropsychological Performance Following Cardiac Resynchronization Therapy for Heart Failure.**

**Objective:** Decreased cardiac ejection fraction has previously been associated with impaired cognition in patients with heart failure. Improving cardiac function may have beneficial effects on cognition; however, few intervention studies have examined this possibly. Cardiac resynchronization therapy (CRT) is a pacemaker/defibrillator intervention for heart failure that optimizes cardiac function through synchronization of ventricular contraction. CRT is associated with increased cardiac function, decreased mortality, and fewer hospitalizations than more conventional pacing. The goal of the current study was to examine cardiac response to CRT and cognitive changes during the 3-months following CRT.

**Participants and Methods:** Twenty-seven patients with moderate to severe heart failure (mean age= 68; SD=8) completed a neuropsychological test battery and measures of cardiac function prior to and 3-months post-CRT. Patients were classified as cardiac responders ( $n=15$ ) or non-responders ( $n=12$ ) based on their improvement in cardiac ejection fraction on echocardiogram. The groups were compared on change in neuropsychological test performance during the 3-month follow-up.

**Results:** No significant improvements in cognition were observed following CRT when all patients were considered together; however, cardiac responders demonstrated significantly greater improvements on global cognition ( $t=-2.17$ ,  $p<.05$ ), visuospatial performance ( $t=-2.09$ ,  $p<.05$ ), and executive functioning measures ( $t=-4.30$ ,  $p>.001$ ) than non-responders.

**Conclusions:** Patients who responded to CRT for heart failure with improved cardiac function also improved on measures of global cognition, visuospatial abilities, and executive functioning 3-months after CRT. Future large scale studies will be necessary to determine whether there is an underlying causal relationship linking change in cardiac ejection fraction and cognition.

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**K.F. HOTH, E. KOZORA & B. MAKE. Changes in Cardiopulmonary Function and Cognition Following Medical Intervention for Emphysema.**

**Objective:** Cognitive impairments are common in patients with emphysema. Treatment studies have observed improvements in cognition following medical intervention (i.e., rehabilitation and lung volume reduction surgery), but those improvements have not consistently been associated with a corresponding change in lung function. The goal of the current study was to examine change in a broader range of cardiopulmonary factors (i.e., hypoxemia, cardiac output, pulmonary hypertension) and cognition following medical intervention for emphysema.

**Participants and Methods:** The study included a subset of participants in the National Emphysema Treatment Trial (NETT) who completed both cardiovascular and cognitive ancillary measures. Sixteen patients with moderate to severe emphysema (mean age= 63; SD=7) were assessed prior to and 6-months after medical intervention. We examined the association between changes in hypoxemia (PaO<sub>2</sub>), cardiac function (cardiac output), and pulmonary hypertension (pulmonary artery pressure) and performance in five cognitive domains (attention, cognitive processing speed, executive functioning, language, and memory) using correlation analysis.

**Results:** Improved blood oxygenation ( $r=.62, p<.05$ ) and decreased pulmonary artery pressure ( $r=-.62, p<.05$ ) were associated with better cognitive processing speed 6-months after medical intervention for emphysema. The associations were strengthened after adjusting for severity of depressive symptoms.

**Conclusions:** These preliminary data suggest that improved blood oxygenation and decreased pulmonary artery pressure following medical treatment for emphysema are associated with improved cognitive processing speed. In this pilot study, it was not possible to examine specific treatment components in relation to the observed cognitive improvement. The findings support the importance of including comprehensive neuropsychological assessment in future emphysema treatment studies.

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**L.J. JULIAN, G. EARNEST, H. WING, E. YELIN & P. KATZ. Cognitive and Physical Functioning among Patients with Chronic Obstructive Pulmonary Disorder.**

**Objective:** To determine predictors of cognitive functioning and performance-based physical functioning in a large cohort of persons with chronic obstructive pulmonary disease (COPD).

**Participants and Methods:** Participants include 188 persons with COPD who participated in a home-based assessment of cognitive function, performance-based physical function tests, pulmonary function tests, and evaluations of psychiatric status (MINI Neuropsychiatric Inventory). Neuropsychological tests included: Hopkins Verbal Learning Test-Revised (learning, recall), D-KEFS Trail Making, Stroop Color-Word, letter and category fluency. A cognitive composite of 6 measures was created using normative data. The physical performance battery included measures of strength, balance, and gait.

**Results:** Mean age was  $64.5\pm 6.3$ , 60% were female, 33% had a college degree or greater, 49% had moderate COPD symptom severity, and 11% met criteria for Major Depressive Disorder. Thirty-two percent of the cohort was impaired on  $\geq 2$  cognitive indices (1/3 of measures). Multivariate regression analyses suggest that after controlling for demographics, both reduced pulmonary function and depression significantly predicted cognitive functioning, accounting for 13% of variance. Cognitive function was an independent predictor of physical function as assessed by the physical performance battery, accounting for an additional 12% of the variance after adjusting for disease status, medical comorbidities, and depression.

**Conclusions:** The purpose of this study was to determine relationships among disease factors, physical function, and cognitive function in a large cohort of persons with COPD. Cognitive dysfunction was present among 32% of the sample and was associated with COPD disease status and mood. Disease related factors, cognitive function, and mood all independently contributed to overall physical function.

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**K.M. MILLER, M.S. OKUN, M. MARSISKE, E.B. FENNELL & D. BOWERS. Arousal-modulated Startle Reflex Hyporeactivity in Parkinson's Disease.**

**Objective:** Prior work in our laboratory found that patients with Parkinson's disease (PD) demonstrate reduced psychophysiological reactivity to unpleasant pictures as indexed by diminished startle eyeblink magnitude (Bowers et al., 2006). In the present study, we tested the hypothesis that this hyporeactivity was primarily driven by diminished reactivity to fear-eliciting stimuli as opposed to other types of aversive pictures. This hypothesis was based on previous evidence suggesting amygdalar abnormalities in PD patients coupled with the known role of the amygdala in fear processing.

**Participants and Methods:** To test this hypothesis, 24 patients with Parkinson's disease and 24 controls viewed standardized sets of emotional pictures that depicted fear, disgust (mutilations, contaminations), pleasant, and neutral contents. Startle eyeblinks were elicited while subjects viewed these emotional pictures.

**Results:** Data were analyzed through repeated measures ANOVAs. Results did not support the hypothesis of a specific deficit to fear pictures. Instead, the PD patients had reduced reactivity to mutilation pictures relative to other types of negative pictures in the context of normal subjective ratings. Further analyses revealed that controls displayed a pattern of increased startle eyeblink magnitude for "high arousal" versus "low arousal" negative pictures, regardless of picture category, whereas startle eyeblink magnitude in the PD group did not vary by arousal level.

**Conclusions:** These results suggest that previous findings of decreased aversion-modulated startle is driven by reduced reactivity to highly arousing negative stimuli rather than to a specific category (i.e., fear or disgust) of emotion stimuli. This may be due to peripheral autonomic nervous system or central nervous system dysfunction.

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**D.M. SCHIEHSER, S. LESSIG, D.D. SONG, R. ELLAM, S. ALISHETTI, R. O'CONNELL & J.V. FILOTEO. Longitudinal Change in Health-Related Quality of Life and Cognition in Parkinson's Disease.**

**Objective:** Health-Related Quality of Life (HRQoL) in Parkinson's disease (PD) is primarily predicted by current levels of mood, in addition to specific motor and cognitive symptoms. However, whether these symptoms are related to changes in HRQoL over time is unknown. The purpose of this study was to examine cognitive, motor, and mood predictors of and longitudinal change in HRQoL in a sample of PD patients.

**Participants and Methods:** Twenty-six participants with PD were administered the Parkinson's Disease Questionnaire (PDQ-39) as a measure of HRQoL. Additional tests administered included the Geriatric Depression Scale (GDS), the Mattis Dementia Rating Scale (DRS), the Unified Parkinson's Disease Rating Scale (UPDRS), and several additional neuropsychological measures. Participants were reassessed with the same battery a mean of 22 months after their initial evaluation.

**Results:** PD patients demonstrated a trend toward a decrease in HRQoL, as measured by the total score on the PDQ-39. A significant decline occurred on the cognitive and communication PDQ-39 subscales. Motor and cognitive deficits declined over the evaluation interval, whereas mood remained stable. Changes in HRQoL were not associated with baseline performances on the UPDRS, GDS, DRS, or other neuropsychological indices.

**Conclusions:** While current mood status has been reported to be an important predictor of current HRQoL, the findings of this study suggest that it is not an important predictor of worsening HRQoL over time. Furthermore, current general cognitive and motor symptoms do not appear to predict a deterioration in HRQoL. Elucidating the causes of HRQoL change in PD is an important area of future research.

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**K.M. STANEK, J. GUNSTAD, J. HUGHES, M. SPITZNAGEL, V. POTTER, R. JOSEPHSON, D. WAECHTER & J. ROSNECK. Cardiovascular Fitness is Associated with Cognitive Impairment and Mood Disturbances in Persons Referred for Nuclear Stress Tests.**

**Objective:** Cognitive impairment and mood disturbances, such as depression, anxiety, and apathy, are common in individuals with cardiovascular disease and may involve similar mechanisms. The current study explored this possibility by examining the relationship between cardiovascular fitness and these cognitive and psychological difficulties.

**Participants and Methods:** Fifty-seven adults (29-81 years) pursuing outpatient evaluation underwent a standardized symptom limited

volitional treadmill stress test. Estimated metabolic equivalents (METs) during maximal exercise served as a measure of cardiovascular fitness. Global cognitive function was assessed using the Mini Mental Status Examination (MMSE). Depression was assessed using the Beck Depression Inventory-2 (BDI-2), state anxiety was assessed using the State-Trait Anxiety Inventory (STAI), and apathy was assessed using the Apathy Evaluation Scale (AES).

**Results:** Partial correlation analyses adjusting for age revealed that maximum estimated METs was significantly associated with performance on the MMSE ( $r = .34$ ,  $p = .01$ ), apathy ( $r = .28$ ,  $p = .04$ ), and state anxiety ( $r = -.33$ ,  $p = .02$ ), but not depression ( $r = -.21$ ,  $p = .12$ ).

**Conclusions:** Results indicate that reduced cardiovascular fitness is related to poorer global cognitive function as well as apathy and anxiety. Although longitudinal studies are needed to clarify the mechanisms involved in these relationships, these findings suggest the possibility that improvements in cardiovascular fitness may lead to associated improvements in cognitive function and affect.

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**A.J. SZABO, J. GUNSTAD, J. HUGHES, M. SPITZNAGEL, V. POTTER, R. JOSEPHSON, D. WAECHTER, J. ROSNECK, K.M. STANEK & L.S. KAKOS. Cardiovascular Fitness, but not Ejection Fraction, is Associated with Specific Cognitive Function in Persons Referred for Nuclear Stress Tests.**

**Objective:** Past research demonstrates that cardiovascular health and cognitive functioning are related, though the mechanism(s) remain unclear. The current study examines two possible mechanisms, systemic perfusion (i.e. ejection fraction) and cardiovascular fitness (i.e. estimated METs) in hopes of further understanding how each contributes to this relationship.

**Participants and Methods:** 54 people who were referred for a nuclear stress test (average age  $62.6 \pm 12.8$ ) completed a small battery of cognitive tests, including Trail Making Test A, Trail Making Test B, Complex Figure Copy and Recall. Estimated METs were quantified during a standardized exercise stress test protocol and ejection fraction quantified during perfusion stress scan. Chart reviews and questionnaires were employed to collect sample characteristics.

**Results:** Partial correlations adjusting for age and sex showed that higher estimated METs was associated with better performance on all cognitive tests (Trail Making Test A,  $r = -0.42$ ; Trail Making Test B,  $r = -0.37$ ; CFT Copy,  $r = 0.30$ ; CFT Delay,  $r = 0.29$ ). Ejection fraction was not significantly correlated with any cognitive tests.

**Conclusions:** Results indicate that cardiovascular fitness is more closely associated with cognitive function in persons with cardiovascular disease than ejection fraction. Further research is needed with a larger, more diverse sample to replicate and clarify these findings.

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**W. WHARTON, C.E. GLEASON, E. BRINTON, M. CEDARS, R.A. LOBO, J. MANSON, G.R. MERRIAM, V.M. MILLER, F. NAFTOLIN, N. SANTORO, H.S. TAYLOR, S.M. HARMAN & S. ASTHANA. Cognitive and Demographic Characteristics of Women Enrolled in the KEEPS (Kronos Early Estrogen Prevention Study) Cognitive and Affective Study (KEEPS C/A).**

**Objective:** The KEEPS (Kronos Early Estrogen Prevention Study) Cognitive and Affective Study (KEEPS C/A) is a multisite, randomized, placebo-controlled, double-blind, parallel-group design addressing hormone-related issues raised by the WHIMS. The objective is to evaluate differential efficacy of oral conjugated equine estrogen (CEE or Premarin®) and transdermal 17  $\beta$ -estradiol with 12 days/month progesterone (Prometrium®) on cognition in healthy non-hysterectomized, women within 6 months - 3 years of menopause. The KEEPS C/A Study will be conducted over 4 years.

**Participants and Methods:** Outcome measures include cognitive tests at baseline and months 18, 36 and 48 during treatment. Month 36 investigates potential progestational effects while months 18 and 48 examine estrogenic effects. The cognitive battery includes: Prospective Memory Test, Modified Mini-Mental State Examination (MMSE2), NYU Paragraphs, Stroop, Digit Symbol, WMS-3 Letter-Number Sequencing, California Verbal Learning Test 2, Mental Rotation, Visual Search, Benton Visual Retention Test and Verbal Fluency.

**Results:** Participants include 720 women, age (mean  $\pm$ SD)  $53.7 \pm 2.5$  years and 77% Caucasian. Baseline BMI is  $26.2 \pm 4.6$  kg/mm<sup>2</sup>, laboratory values (mg/dL) are: Total cholesterol  $215 \pm 31.8$ , HDL cholesterol  $65.0 \pm 17.2$ , LDL cholesterol  $129.9 \pm 29.3$ , triglycerides  $91.2 \pm 51.0$ , and fasting glucose  $89.0 \pm 9.9$ . Women are cognitively healthy (MMSE2 =  $28.9 \pm 2.1$ ). Interestingly, a positive relationship ( $r = .150$ ,  $p < .01$ ) is observed between plasma estradiol and MMSE2 total score.

**Conclusions:** Baseline physiological and cognitive data indicate that the cohort is healthy and free of cognitive dysfunction. The correlation between estradiol and MMSE score supports prior data reporting estradiol's salutary effect on cognition.

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**T. WIMBERLY OLIVIER, D.G. NEMETH & T. WHITTINGTON. What is the Real Measure of Successful Rehabilitation?**

**Objective:** Three years ago, a neurocognitively impaired adult was referred by a state rehabilitation agency for neuropsychological evaluation. A comprehensive report, including diagnostic impressions and detailed recommendations was issued. As a result, this individual was placed in a suitable job, but was not given the appropriate supportive interventions.

**Participants and Methods:** This individual was recently re-referred by the same agency for the same type of evaluation. He had recently been fired from his job of almost three years, reportedly for behavioral reasons. Results of the second assessment revealed little change in this individual's intellectual and/or neurocognitive status. Considerable deterioration of his affective and behavioral functioning had, however, occurred.

**Results:** Without the recommended psychopharmacological and cognitive-behavioral interventions, this individual had become increasingly anxious, paranoid, resentful, aggressive, and affectively and behaviorally unstable. These dynamics began to interfere with his work-related relationships and eventually resulted in dismissal.

**Conclusions:** Evaluation without intervention is often ineffective in the rehabilitation setting. Putting a person back to work is only the beginning of the rehabilitation process. Helping to keep the person stable so that he can maintain his job is the real measure of success.

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**L.B. ZAHODNE, M.S. OKUN, K.D. FOOTE, H.H. FERNANDEZ & D. BOWERS. A Reliable Change Analysis of Cognitive Declines One Year after Unilateral Deep Brain Stimulation Surgery in Parkinson's Disease.**

**Objective:** Conflicting research suggests that deep brain stimulation (DBS) surgery, an effective treatment for medication-refractory Parkinson's disease (PD), may lead to selective cognitive declines, particularly in verbal fluency. We sought to examine the magnitude, specificity, and predictors of cognitive changes after unilateral DBS surgery.

**Participants and Methods:** We compared cognitive performance of 22 PD patients who underwent unilateral STN or GPi DBS to 19 medically-treated PD controls of similar age at baseline and 12 months. We hypothesized that DBS patients would decline on tasks involving dorsolateral prefrontal cortex circuitry (verbal fluency and working memory), but not on other tasks (semantic knowledge), and that a greater proportion of DBS patients would fall below Reliable Change Indexes (RCIs).

**Results:** Compared to controls, DBS patients declined only on the fluency tasks (FAS and Animals). Compared to only 11% of controls, 50% of the DBS patients declined on at least one fluency measure. Amongst DBS patients, decliners experienced less motor improvement than non-decliners, and left-sided surgery was associated with semantic fluency decline.

**Conclusions:** Results provide evidence that unilateral DBS surgery is associated with verbal fluency declines. These changes do not appear systematically related to age, cognitive or depression status at baseline. Semantic fluency declines are more common after left-sided surgery. The use of Reliable Change highlights the impact of individual variability and indicates that fluency declines likely reflect significant changes in a subset of patients who demonstrate less robust surgical outcome. Correspondence: *Laura B. Zahodne, MS, Clinical & Health Psychology, University of Florida, P.O. Box 100165, Gainesville, FL 32610-0165. E-mail: lzahodne@phhp.ufl.edu*

### TBI (Adult)

**J. ANDERSON, V. COUKOULIS & M. SCHMITTER-EDGECOMBE. The Recovery of Time Estimation following Moderate to Severe Traumatic Brain Injury.**

**Objective:** The ability to accurately estimate time has many implications for everyday activities such as planning and coordinating behaviors. Past research has suggested that individuals in the early stages of recovery following traumatic brain injury (TBI) accurately estimate time for durations less than 30 seconds, but are less accurate for durations longer than 30 seconds. The present study utilized a prospective verbal time estimation strategy to investigate the process of recovery in temporal estimation following TBI.

**Participants and Methods:** Fifteen moderate to severe TBI participants and 15 neurologically normal controls matched on age and education completed a prospective verbal time estimation paradigm. Time perception was investigated for filled intervals of 10, 25, 45, and 60 seconds. Baseline data was assessed within 10 weeks time since injury (TSI). Follow-up data was collected over 55 weeks TSI. Measures of time estimation included absolute discrepancy and duration judgment ratio scores.

**Results:** At baseline, the absolute difference between estimated and actual time was significantly greater for the TBI group than controls, and increased to a greater degree with longer time durations. The duration judgment ratio revealed that TBI participants greatly underestimated time compared to controls. At the 12-month follow-up, there was no difference between groups for absolute differences and duration judgment ratio scores.

**Conclusions:** Overall, TBI participants had more difficulty estimating time at baseline than controls, but were as accurate as controls after 12 months. These data suggest that time perception abilities show recovery during the first 12 months post-TBI.

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**S.M. BELKONEN, A.S. YI, C.I. HIRSHSON & J.B. CANTOR. Cognitive Functioning and Participation in Adults with Traumatic Brain Injury (TBI).**

**Objective:** The goal of the current study was to examine whether cognitive functioning relates to participation in activities and satisfaction with participation in individuals with TBI, as compared to adults without TBI.

**Participants and Methods:** One hundred and twenty-six community dwelling adults with TBI (Mean age = 47.47, SD = 12.61) and 42 adults without TBI (Mean age = 40.96, SD = 12.46) were recruited at a large urban medical center. They completed the Cambridge Neuropsychological Assessment Battery (CANTAB), a computerized battery of neu-

ropsychological tests, and the Participation Objective, Participation Subjective (POPS), a measure of objective participation and satisfaction with participation. The POPS yields indexes of participation in major life activities transportation, interpersonal life activities, community life activities and overall participation.

**Results:** Three primary factors previously identified in a sample of adults with TBI (Ashman et al., 2008) were used as outcome variables for the CANTAB: speed, accuracy, and executive functioning. There were no significant correlations between CANTAB factor scores and POPS objective and subjective scores ( $p > .05$ ) in adults with or without TBI.

**Conclusions:** These results suggest that cognitive functioning, as measured by the CANTAB, may not be strongly related to amount of participation or satisfaction with participation in a variety of life activities in individuals with TBI and the population in general.

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**J. BENGE, G.M. THORNTON, R.E. DARROW & N.J. PASTOREK. Post-Concussive Symptoms in OEF/OIF Veterans: Factor Structure and Impact of PTSD Symptomatology.**

**Objective:** In veterans with mild traumatic brain injury (mTBI), post-concussional symptoms and post-traumatic stress disorder (PTSD) are common. The structure of post-concussional symptoms is poorly understood, and the impact of PTSD on post-concussional symptoms remains unclear. The current study sought to address these issues by employing factor analysis of post-concussional symptoms and exploring their relation with PTSD symptoms.

**Participants and Methods:** 216 Operations Enduring/Iraqi Freedom (OEF/OIF) veterans completed the PTSD Checklist (PCL) and the Neurobehavioral Symptoms Inventory (NSI), a measure of post-concussional symptoms. NSI scores were submitted to factor analysis and correlated with PCL scores. To further evaluate the impact of PTSD on post-concussional symptoms, factor analysis was repeated on the residuals of NSI scores after controlling for PTSD symptoms.

**Results:** Initial analysis of the NSI factor structure revealed a 3-factor solution which suggested a strong cognitive/affective factor and two smaller factors made up of physical and cognitive/affective items. Scores on the first factor correlated strongly with PTSD symptoms, especially with hyperarousal. When the analysis was repeated on residuals of NSI scores after controlling for PTSD severity, a 7 factor structure emerged which consisted of common clinical syndromes following mTBI (i.e. migraines, sensory sensitivity, cognitive/affective problems).

**Conclusions:** PTSD symptoms may obfuscate interpretation of PCS self-reported post-concussional symptoms. When PTSD symptoms are controlled for, the structure the NSI more closely mirrors common clinical syndromes following mTBI. Research on post-concussional symptoms in veterans with PTSD must take into account the overlapping nature of these latent variables. Implications for evaluation and treatment are discussed.

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**E.L. BERCAW, R.A. HANKS, T.J. GOLA, S.R. MILLIS & B. WALDRON-PERRINE. Cognitive Recovery After Traumatic Brain Injury (TBI) from Inpatient Rehabilitation to 1-year and 2-year Follow-up: Relationship to Functional Outcomes.**

**Objective:** Early neuropsychological testing of TBI patients significantly predicts important functional outcomes. The present study explored the predictive value of interval change in neuropsychological performance at 3 time-points (inpatient rehabilitation, 1-year, and 2-year follow-up) on functional outcome measures.

**Participants and Methods:** Participants were 334 patients age 16-84 receiving inpatient rehabilitation for moderate-to-severe TBI who underwent neuropsychological evaluation at 1-year and/or 2-years post-injury. Neuropsychological assessment included the Trailmaking Test

A&B (TMT), Rey Auditory Verbal Learning Test (RAVLT) or California Verbal Learning Test-II (CVLT-II), Wechsler Test of Adult Reading (WTAR), Symbol Digit Modalities Test (SDMT), Controlled Oral Word Association Test (COWAT), and Grooved Pegboard. Functional outcome measures included the Functional Independence Measure, Disability Rating Scale, Glasgow Outcome Scale- Extended, and Supervision Rating Scale.

**Results:** Symmetrized percent change scores were calculated and used to predict scores on functional measures using linear regression. Improvement from inpatient to 1-year follow-up for each cognitive measure (16-39% mean performance change) was predictive of one or more functional ratings at 2-year follow-up ( $p < .05$ ). Inpatient to 2-year improvement (18-35% mean performance change) was also predictive of various outcomes ( $p < .05$ ), whereas change from 1-year to 2-years post-injury was generally non-significant when controlling for age and baseline severity.

**Conclusions:** Results indicated that both inpatient assessment and the degree of change in neuropsychological performance between inpatient evaluation and 1-year and 2-year follow-up appear meaningful in predicting longer term functional outcomes; however change in scores from 1 to 2 years post-injury was not predictive of outcome.

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#### **B. BOATWRIGHT, F. HAMMOND, A.Y. STRINGER & V. PHILLIPS. Predicting Subjective Quality of Life One Year After Traumatic Brain Injury.**

**Objective:** Current evidence suggests that traumatic brain injury (TBI) lowers subjective quality of life (SQOL) in a manner not readily predicted by injury severity. Identifying predictors of SQOL may help direct clinical interventions to where they provide the most benefit from the patient's perspective. The current study attempts to identify predictors of SQOL at 1 year post TBI.

**Participants and Methods:** Participants were 163 Georgia and North Carolina TBI Model System patients. Data, collected during the first year post-injury, included premorbid history, demographics, causes and severity of injury, co-morbidities, services received, and outcomes. The sample was predominantly male ( $n=108$ ), young (mean age=35.76), and Caucasian (116), with the TBI ranging from mild to severe. Trained interviewers administered the Quality of Well Being Scale (QWB) at rehabilitation discharge and at 6 and 12-month follow-up. We report 12-month follow-up data.

**Results:** Stepwise multiple regression revealed that motor functioning accounted for the most variance in QWB [ $R^2 = .18, F(1,161)=35.48, p < .001$ ], followed by employment status [ $R^2 = .25, F(1,160)=13.65, p < .001$ ], mood [ $R^2 = .28, F(1,159)=7.08, p < .01$ ], and therapist ratings of cognition [ $R^2 = .30, F(1,158)=5.18, p < .02$ ]. Of the neuropsychological variables tested in the regression model only visual discrimination was predictive of QWB scores [ $R^2 = .33, F(1,157)=6.81, p < .01$ ].

**Conclusions:** The primary predictors of SQOL at 12 months post-TBI were motor functioning, employment, mood, cognition rating, and visual discrimination. Neuropsychological performance overall was not a significant predictor. Clinical interventions that stabilize mood, and improve motor and vocational outcome may have the most beneficial effects on long term quality of life after TBI.

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#### **K.S. CHIOU, N.M. FITZPATRICK, R.G. FRANKLIN, J. VESEK, E. HILLS, D.C. GOOD, J.L. WANG, Q.X. YANG & E.G. HILLARY. Examining the Effect of Task Practice on Functional Brain Activation in Traumatic Brain Injury.**

**Objective:** Working memory (WM) is often impaired following traumatic brain injury (TBI). Studies using functional imaging have revealed

that WM deficits after TBI are associated with increased activation of the prefrontal cortex (PFC) and anterior cingulate cortex (ACC). This neural recruitment has often times been labeled as neural "reorganization," implying permanent alterations to neural networks, as opposed to transient neural recruitment based upon task performance. Determination of the permanence of neural recruitment in TBI requires the examination of the relationship between task performance and functional brain activation. The nature of neural recruitment in TBI was investigated by observing changes in activation during a WM task at two time points separated by a practice session used to enhance task performance.

**Participants and Methods:** The study consisted of 9 individuals with severe TBI and a healthy control comparison group. Functional MRI data were collected while participants completed WM tasks during 2 separate scanning sessions on the same day. Between scanning sessions, participants practiced each of these WM tasks outside the scanner.

**Results:** As expected, task practice resulted in improved performance for both healthy adults and individuals sustaining TBI. Importantly, improved performance was also associated with reduced involvement of PFC resources.

**Conclusions:** Decreased functional activation evident in the post-practice scanning session illustrates that PFC recruitment in TBI is a transient phenomenon and closely tied to task performance. These findings suggest that neural recruitment in TBI represents the auxiliary support networks due to diminished performance rather than permanent reorganization of WM networks.

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#### **J.A. CLARK, A.L. SHANDERA, J. HARP, R. SCHLEENBAKER & W.M. HIGH. Neuropsychological Profile of Combat Veterans Exposed to Mild Head Trauma and Combat-Related Stressful Events.**

**Objective:** Current combat veterans are exposed to many incidents that may result in mild traumatic brain injury (mTBI). The purpose of this study was to compare the neuropsychological profile of mTBI veterans who met DSM-IV-TR criteria for PTSD and those who did not. It was hypothesized that those with PTSD would perform significantly worse on measures of memory (CVLT-II) and executive functioning (WCST and D-KEFS Color-Word Interference).

**Participants and Methods:** Twenty recent combat veterans were referred for neuropsychological evaluation following possible mTBI and combat-related stress. Of these, 1 lacked evidence of brain injury, 2 elevated MMPI-2 validity scales, and 2 failed a neurocognitive test of effort (Letter Memory Test). Of the remaining 15 veterans, (15 Caucasian, 14 males), approximately half experienced a loss of consciousness at the time of injury ( $n=7$ ) while the others had an alteration of consciousness ( $n=8$ , dazed/confused). All participants were given an extensive clinical interview, a battery of neuropsychological tests, emotional/behavioral measures, and a PTSD screen.

**Results:** One-tailed t-tests indicated that the PTSD group ( $n=11$ ) performed significantly worse on neurocognitive tests ( $p < .05$ ). Group differences were found on CVLT-II delayed recall measures, WCST (total errors and perseverative responses), and D-KEFS (Color-Word Interference). Additional group differences were found on finger tapping and form discrimination. Evidence also suggested additional subtle cognitive deficit due to mTBI (when stress was controlled) than was seen due to PTSD.

**Conclusions:** These results suggest that combat veterans with PTSD experience greater cognitive difficulty than those who do not. Implications are discussed, including treatment recommendations and the prevalence of symptom exaggeration.

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**V.L. CLEMENT, G. BEVERLY, R. NAKASE-RICHARDSON, R.A. HANKS, M. SHERER & C.C. EVANS. WTAR Performance Scores Susceptible to Cognitive Impairment Early After TBI.**

**Objective:** The Wechsler Test of Adult Reading (WTAR) is a widely used measure to estimate pre-morbid IQ in clinical groups experiencing decline in cognitive function. This measure relies upon an individual's ability to read irregular words that cannot be decoded using phonological strategies and would relate to intellectual level and education. However, there is debate in the literature whether this test is impervious to change from brain dysfunction particularly traumatic brain injury (TBI; Mathias, Bowden, Bigler, Rosenfeld & 2007; Morris et al., 2005). The purpose of this study is to evaluate the relationship of demographic, injury severity, and cognitive performance measures with WTAR performance scores.

**Participants and Methods:** The study is comprised of 111 participants admitted to one of two TBI Model Systems neurorehabilitation hospitals. Participants were primarily African-American (52%) males (82 %) with a median age of 33. Study participants were administered a brief neuropsychological battery during inpatient rehabilitation 1 month ( $\pm$  2 weeks) post-injury.

**Results:** Of the 111 participants, 47% yielded cautionary performance standard scores compared to demographic predicted standard scores that question the value of WTAR in predicting IQ at one month post injury. The median standard score difference for this subgroup was 24. Spearman correlations with bonferroni corrections revealed significant relationships between WTAR performance FSIQ and education, cognitive measures (attention, disorientation, executive functioning, verbal fluency), and injury severity ranging from .43 to .31

**Conclusions:** WTAR performance scores are susceptible to cognitive impairments and injury severity early after TBI. WTAR performance scores should be interpreted with caution early after TBI.

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**A. CRALIDIS & K. LUNGGREN. Verbal Fluency Patterns in Individuals with Traumatic Brain Injury.**

**Objective:** Many individuals with acquired brain damage have difficulty generating words when given a specific category. As such, a complete analysis of the types of words generated and the types of errors produced, as well as the types of clustering patterns therein, may provide a better indication of the type of difficulty that these individuals display on this type of cognitive-linguistic measure.

Previous studies that have examined patterns of semantic clustering in populations who are free from neurological illness suggest that exemplars are generated in an organized manner. For instance, within the category of animals, exemplars are generally grouped along three dimensions: size, domesticity, and prototypicality. Further, grouping patterns have also been identified on tasks of phonemic verbal fluency, whereby exemplars tend to be organized along an animate-inanimate dichotomy. However, few studies have identified the specific patterns of exemplar generation that may characterize the verbal fluency patterns exhibited by a population with traumatic brain injury (TBI). As such, the objective of the present study sought to identify these patterns.

**Participants and Methods:** Five adult participants with moderate to severe TBI were given verbal fluency measures as a part of a larger test battery given to them before participating in a structured training program. Their responses on these verbal fluency measures were analyzed to determine patterns of performance relative to types of errors, patterns of errors, and production patterns within exemplar clusters.

**Results:** During the semantic verbal fluency task (i.e., animals), participants generated six unique patterns. For the phonemic verbal fluency task (i.e., the letter M), five unique patterns of production within exemplar clusters were identified.

**Conclusions:** In this small group of individuals with TBI, distinct patterns of performance were identified. The results of this study and potential influence will be discussed.

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**S. DIKMEN, J. MACHAMER & N.R. TEMKIN. Natural History of Post-Traumatic Symptoms.**

**Objective:** Objective: Examine reporting of new or worse post traumatic symptoms at 1 month and 1 year after traumatic brain injury (TBI).

**Participants and Methods:** Participants and Methods: 730 adults hospitalized for TBI were enrolled on the study during acute hospitalization and followed prospectively to one year. They were compared to 120 Trauma Controls (TC) who sustained traumatic injury to other parts of the body but not the head. Both groups were administered the TBI Symptom Checklist, a list of 12 symptoms that commonly are reported following traumatic brain injury. Participants were asked if each symptom was new or worse compared to pre-injury at 1 month and 1-year post injury. A total score of the number of new or worse symptoms was computed

**Results:** Results: At 1 month post injury, TBI Ss reported significantly more symptoms than TC ( $p < .001$ ) with the most commonly reported being fatigue, headache and dizziness, all reported by more than 50% of the TBI. At 1 year, both groups reported fewer symptoms but the TBI continued to report significantly more symptoms than TC ( $p < .001$ ) with memory problems, fatigue and irritability being the most commonly reported. There were no significant differences in symptom reporting at 1 year by TBI severity subgroups using the Glasgow Coma Scale.

**Conclusions:** Conclusions: Symptom reporting is common following traumatic injury and continues to be experienced by a substantial number of TBI subjects at 1-year post injury. More work needs to be done to clarify the reasons for differences in the estimated rates in the literature, the significance of symptoms and conditions under which they become disabling.

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**S.N. GORDON, A.L. ZARTMAN, K.R. KRUEGER, K.D. VANBUREN & R.C. HILSABECK. Effects of PTSD and Other Psychiatric Disorders on Cognitive Functioning in Veterans with Mild TBI.**

**Objective:** There has been increased interest in mild TBI (mTBI) and PTSD due to their prevalence in returning Iraqi/Afghanistan war veterans. It has been speculated that these conditions may have a synergistic, negative effect on cognitive functioning. The purpose of this study was to determine if differences exist in processing speed and mental flexibility in individuals with mTBI and PTSD or other psychiatric conditions.

**Participants and Methods:** Participants included 20 veterans with mTBI and PTSD, 20 veterans with mTBI and other psychiatric diagnoses, and 28 veterans with mTBI without psychiatric diagnoses. Average age of the sample was 50.0 years ( $SD=13.3$ ), and average education was 12.8 years ( $SD=2.7$ ). Eighty-seven percent were men. Most were non-Hispanic White (57%) or Hispanic (31%). Only veterans obtaining valid performances on the Test of Memory Malingering were included. All participants completed the Trail Making Test, Stroop Color and Word Test, and selected subtests of the WAIS-III as part of a neuropsychological evaluation. One-way ANOVAs and Chi-square analyses were conducted to determine if significant differences existed among the groups.

**Results:** Groups did not differ in age, education, gender, or ethnicity. There were no significant group differences in neurocognitive performances, percentages of participants receiving a cognitive disorder diagnosis, or level of impairment. Percentages of veterans with impaired performances ranged from 8% to 38%.

**Conclusions:** These findings suggest that PTSD and other psychiatric disorders do not necessarily exacerbate problems with processing speed and mental flexibility in veterans with mTBI.



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**L.A. GREENBERG, A. HULL, L. HUTSON, C. SULLIVAN, B. BELSHER, D. THOMANDER & J. POOLE. Facial Affect Recognition Ability in Veterans who Screen Positive for Traumatic Brain Injury (TBI): Contribution of Emotional and Cognitive Factors.**

**Objective:** To determine whether veterans screening positive for TBI have difficulty recognizing facial affect, and to identify the contribution of emotional and cognitive factors.

**Participants and Methods:** Subjects were 52 mainly male outpatient veterans, screened positive on a standard VA TBI screen, with possible mild to moderate TBI. Most participants had symptoms consistent with postconcussion syndrome with comorbid PTSD and mood disturbance. Subjects completed Ekman's Facial Affect Recognition (FAR) task as part of a standard neuropsychological battery. To identify predictors of FAR, regression analyses were conducted, entering both cognitive measures (WAIS-III Processing Speed Index, Spatial and Executive Indices of the S-NAB Screening Module), and emotional measures (PTSD Checklist, Post-Traumatic Anxiety and Depression Inventories).

**Results:** FAR scores were significantly below normal (mean = -0.94 SD). Cognitive and emotional measures together accounted for 32% of variance in FAR ( $R = .56, p = .006$ ). 14% of the variance was uniquely accounted for by cognitive variables; 9% of variance was uniquely accounted for by emotional variables, suggesting that the remaining 9% of the variance in FAR scores was shared by emotional and cognitive components.

**Conclusion:** Findings suggest that (1) TBI and emotional disorders may impair the ability to recognize facial affect; (2) part of this difficulty was related to reduced cognitive capacity (i.e. processing speed, spatial, and executive skills) and emotional symptoms (mainly depression and anxiety), and (3) affect recognition tests appear to measure a unique area of functioning not fully captured by other tests. In this veteran population, affect processing measures can help characterize an important dimension of neuropsychological functioning.

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**S.C. HEATON, G.Z. RECKESS, P. WEN, K. WAID-EBBS, N. DONOVAN, F. SINGLETARY & C. VELOZO. Concurrent Validity of the Computer Adaptive Measure of Functional Cognition for Traumatic Brain Injury (CAMFC-TBI).**

**Objective:** The ecological validity of neuropsychological measures unclear and extensive testing can place a prohibitive burden on patients recovering from TBI. In contrast, rating scales and questionnaires often fail to assess all relevant areas of cognition and often have poor psychometric properties. The Computer Adaptive Measure of Functional Cognition for Traumatic Brain Injury (CAMFC-TBI) is a new measure developed to assess cognitive functioning in daily life activities across five domains: Attention, Memory, Processing Speed (PS), Executive Functioning, Emotional Management and Social Communication. It was designed using Item Response Theory (IRT) and can be completed either through patient self-report or proxy-report (i.e., caregiver or treating healthcare professional). The current study examined the concurrent validity of this new measure.

**Participants and Methods:** The CAMFC-TBI was completed by patients recovering from TBI ( $n=90$ ), and by their caregivers ( $n=89$ ) and healthcare professionals ( $n=48$ ). Patients completed an abbreviated battery of neuropsychological tests (Digit Span, HVLT, Symbol Search, Coding) and traditional rating scales were obtained (BRIEF-A, ASHA-FACS, FIM/FAM) to represent the cognitive constructs assessed by the CAMFC-TBI.

**Results:** All CAMFC-TBI domain scores were significantly correlated with their respective performance- and report-based traditional measures, with the exception of Processing Speed (only significant for caregiver ratings) and Attention (not significant for patient, caregiver, or healthcare professional ratings). Correlation magnitudes ranged from weak ( $r = .288$ ) to moderate ( $r = .645$ ).

**Conclusions:** This initial validation study suggests the CAMFC-TBI is a promising tool for assessing functional cognition after TBI. Concurrent validity varied across rater type and CAMFC-TBI domain. These interactions warrant additional examination.

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**T. HEITZMAN. Evaluating the Validity of the BISQ in a Sample of College Students With and Without Reported Head Injury.**

**Objective:** The Brain Injury Screening Questionnaire (BISQ) is a structured self report used in determining (a) history of brain injury, and (b) physical, cognitive and behavioral sequelae following injury. The current study investigated the validity of the BISQ and its relationship to other standardized instruments used in neuropsychological assessments.

**Participants and Methods:** Fifty undergraduates participated in the study. Twenty-one reported features consistent with concussion or mild TBI. Each completed the BISQ, BASC-2, BRIEF and the ImPACT computerized test. Pearson's Product Moment Correlation Coefficients were calculated to measure the association between BISQ factors with each of the other measures.

**Results:** Results revealed a significant relationship between BISQ symptomatology and emotional and behavioral factors reported on the BASC-2. Much less association was found between the BISQ and the BRIEF. Although BISQ factors were significantly correlated with similar symptomatology on the ImPACT test, no relationship was found with the cognitive screening variables on the latter. Results remained consistent when evaluating only those students with reported head injuries.

**Conclusions:** The BISQ has clear face-validity when used to assess the history of brain injury. These results also support the convergent-validity of the BISQ when measuring physical, cognitive and behavioral factors associated with brain injury. Specific sensitivity to executive functioning deficits was not demonstrated, but sensitivity to general inattention and impulsivity was significant as compared to the BASC-2. The significant correlation between BISQ factors and emotional variables on the BASC-2 highlight the importance of considering emotional adjustment during recovery following brain injury.

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**A. HULL, L. GREENBERG, L. HUTSON, C. SULLIVAN, B. BELSHER, D. THOMANDER & J. POOLE. Comparison of the Repeatable Battery for Assessment of Neuropsychological Status (RBANS) and Neuropsychological Assessment Battery Screening Module (S-NAB) in Veterans Screened Positive for History of TBI.**

**Objective:** This study compares the RBANS and S-NAB in the initial assessment of VA patients who screened positive for possible traumatic brain injury (TBI).

**Participants and Methods:** Subjects were 40 outpatient veterans, ages 20-58, who screened positive for possible TBI on a standard VA screen, and whose histories suggested possible mild to moderate TBI. Subjects were given the S-NAB and RBANS as part of a standard assessment battery. Analyses compared S-NAB and RBANS standard scores for attention, memory, language and visuospatial skills.

**Results:** S-NAB and RBANS Attention and Memory indices were significantly correlated ( $r = 0.8$  and  $0.7$ ); their Language and Spatial indices were not ( $r < 0.3$ ). RBANS scores were significantly lower than S-NAB scores for Memory (-0.9 SD) and Language (-1.2 SD). Beck Anxiety and Depression indices correlated significantly with S-NAB and RBANS Attention, S-NAB Memory, and S-NAB Spatial indices ( $r = -0.4$  to  $-0.5$ ).

**Conclusions:** This study indicates that the RBANS and S-NAB are not equivalent. Their attention and memory tests tap similar functions, but their language and spatial tests do not. The S-NAB includes an executive index, but the RBANS does not. Furthermore, patients in our TBI clinic obtained lower memory and language scores on the RBANS than the S-NAB. Possible reasons include differences in the RBANS and NAB normative samples, floor/ceiling effects, and the sensitivity/specificity of items, which will be discussed in this presentation. Understanding the contents and relative difficulty of these two popular screening batteries can help clinicians select appropriate tests for specific patient populations.

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**L.R. HUTSON, C. SULLIVAN, E. MARTIN, K. SCHWAB & J. POOLE. Long-Term Assessment of Recovery after Moderate to Severe TBI: Comparison of Two Community Re-Entry Scales, as rated by Patients and Informants, and their Relation to Coping Mechanisms.**

**Objective:** (1) Compare two community re-entry scales, the Community Integration Questionnaire (CIQ) which has been widely researched, and the Mayo-Portland Participation Index (M2PI) which has recently been proposed as a brief, stand-alone measure. (2) Determine agreement of patients' and informants' rating on these scales. (3) Examine how coping styles are related to community re-entry 5-16 years after moderate to severe TBI (msTBI).

**Participants and Methods:** 23 military veterans received acute inpatient rehabilitation for msTBI at our regional center, and then completed a comprehensive telephone interview 5-16 years later (median 11), at ages 26-63 (median 38). Subjects and a collateral informant completed the CIQ, M2PI, the Personal Mastery Scale which measures locus of control, and the Coping with Health Injuries & Problems which measures coping styles.

**Results:** (1) The M2PI and CIQ were correlated  $r = 0.8$  overall. (2) Patients' and informants' ratings showed excellent agreement on the M2PI (ICC = 0.85) and CIQ (ICC = 0.79), with no significant differences between these raters on any items. (3) Subjects with greater community re-entry showed more internal locus of control ( $r = 0.6$ ), and made greater use of two coping strategies: instrumental problem-solving ( $r = 0.42$ ) and distraction by pleasurable activities ( $r = 0.47$ ).

**Conclusions:** The M2PI demonstrates good concurrent validity with the CIQ. Also, ratings by patients and informants show high agreement on all items of these scales. Patients who attain greater community integration show more internal locus of control and more coping strategies that involve active problem-solving and seeking alternate sources of enjoyment. Possible mechanisms of this effect are discussed.

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**B. BELSHER, L.R. HUTSON, C. SULLIVAN, A. HULL, L. GREENBERG & J. POOLE. Neuropsychological Sequelae of Pure Blast Exposure Among Recent Combat Returnees Screened Positive for Traumatic Brain Injury (TBI).**

**Objective:** (1) Identify neuropsychological and emotional deficits in a sample of combat returnees who were exposed to explosive blasts with no other identifiable surgical injuries. (2) Identify potentially distinct contributions from the emotional and executive post-traumatic effects of blast exposure.

**Participants and Methods:** Forty veterans (median age = 25), screened positive on a standard VA TBI screen, whose histories indicated possible mild TBI within the last 5 years. All reported altered mental functioning, with 41% reporting loss of consciousness and 57% reporting posttraumatic amnesia, as a result of one or more blasts. Almost all subjects had current symptoms consistent with postconcussion syndrome (PCS) and/or posttraumatic stress disorder (PTSD) and mood disturbance. Subjects were given a standard neuropsychological battery.

**Results:** Subjects showed subnormal performance (group mean is -0.5 to -1.5 SD below normative mean) on several measures of motor, attention, delayed memory, and executive skills. These subjects also showed significant mood disturbance on measures of depression, anxiety, and PTSD symptoms. Some, but not all, of the low neuropsychological scores were correlated with these measures of emotional distress.

**Conclusions:** The findings describe a neuropsychological profile for recent combat returnees exposed to blasts. This research agrees with previous studies that have reported reduced cognitive functioning within this population. It also concurs with previous research finding mild cognitive impairment in patients with PCS or PTSD. Analyses indicated that some neuropsychological measures likely reflect the combination of emotional and neurological effects of blast injury while others tests may be pure measures of either dimension alone.

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**F. PARENTE, C. JOHNSON & P. JENNINGS. Subjective Organization Patterns Discriminate TBI From Other Populations.**

**Objective:** The ability to organize seemingly unrelated events in memory diminishes following brain injury. Because transfer paradigms have been used extensively for studying subjective organization, the present investigation explored the possibility of using a whole-whole transfer paradigm as a diagnostic tool for detecting changes in this ability after brain injury. In this paradigm, participants first learn one list of words and then must learn a second list that includes both items from the first list (overlapping) as well as an equal number of new items (non-overlapping). In general, participants without brain damage take longer to learn the overlapping items on the second list than those with brain injury, suggesting that the latter were subject to less interference from the subjective organization of the overlapping material that occurred during the initial learning.

**Participants and Methods:** The present study tested participants in a whole-whole learning paradigm: 87 college students, 50 persons with traumatic brain injury referred for neuropsychological evaluation, and 30 persons with Specific Learning Disabilities (SLI) also referred for evaluations. Each participant learned two lists of words presented orally at 2-second intervals; half of the items on the second list were from the first list and half were new. Four study-test trials were given for the learning of each list, with the words presented randomly on each presentation.

**Results:** The results indicate that for the college students and the SLI participants, there was a significant crossover interaction. That is, these groups initially recalled the overlapping words between the two lists better than they recalled the non-overlapping words; however, this pattern reversed during the later trials. In contrast, the TBI group data showed no significant interaction.

**Conclusions:** The results indicate that different patterns of performance on this task can discriminate organizational deficits in persons with brain injury.

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**A.L. JOHNSON, S. TUN, T. DEMADURA & D. STORZBACH. Neuropsychological Functioning and PTSD in OIF/OEF Veterans Exposed to Blasts: Preliminary Findings.**

**Objective:** Post traumatic stress disorder (PTSD) has been strongly associated with mild traumatic brain injury (MTBI) in Operation Iraqi Freedom (OIF) veterans (Hoge, et al, 2008). We hypothesize that PTSD severity will negatively correlate with neuropsychology performance in blast-exposed OIF and Operation Enduring Freedom (OEF) veterans.

**Participants and Methods:** Eligible veterans, referred to the Portland VA neuropsychology clinic, were recruited to participate in the

study. Assessment consists of comprehensive examination of both psychological and neuropsychological functioning. Of the 23 participants, we excluded 8 participants due to missing data and poor performance on the Test of Memory Malingering (TOMM; Tombaugh, 1996). Data from 15 participants were used in the analyses. One-tailed correlations were performed.

**Results:** We found negative correlations between PTSD severity, as measured by the PTSD Checklist- Military Version (PCL-M; Weathers, Huska, Keane, 1991), and performance on the Neuropsychological Assessment Battery (NAB; Stern & White, 2003). PCL-M scores were negatively correlated with total performance on the NAB attention module ( $p < .05$ ), and with two particular indices of the attention module: Numbers & Letters A- efficiency ( $p < .05$ ) and Numbers & Letters D- efficiency ( $p < .05$ ). Two negative trends were also found between PCL-M and other attention indices: Digits Forward and Numbers & Letters A-speed.

No negative correlations were found between PCL-M and other NAB modules. Unexpectedly, we found a positive correlation between PCL-M and a particular NAB memory task: List Learning B-immediate recall ( $p < .05$ ).

**Conclusions:** Preliminary findings suggest that PTSD is associated with poorer performance on measures of attention in blast-exposed OIF/OEF vets.

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#### I. KELLISON, S.C. HEATON, K. WAID-EBBS, P. WEN & C. VELOZO. Comparison of Adult Traumatic Brain Injury (TBI) Patient and Caregiver Ratings of Executive Functioning on the Behavior Rating Inventory of Executive Function (BRIEF-A).

**Objective:** TBI can result in deficits in cognitive and behavioral/emotional aspects of executive functioning (EF). Prior research investigating outcome rating scales suggests that patients are less likely to acknowledge deficits in EF than other domains. However, it is unclear which specific EF domains are under-reported.

**Participants and Methods:** The BRIEF-A is a relatively new self-report and caregiver-report questionnaire measuring nine domains of everyday EF. We examined BRIEF-A self-reports and caregiver-reports of 89 TBI patients to examine the nature of problems reported and whether discrepancies existed between the two reporters.

**Results:** Analysis of self- versus caregiver-report revealed that caregivers rated patients higher (worse) on cognitive EF scales than patients rated themselves (Initiate, Plan, Monitor, Organize Materials; all  $p$ 's  $< .05$ ), with the exception of Working Memory ( $p = 0.26$ ). In contrast, patients and caregivers did not differ in reported symptom severity of behavioral/emotional EF problems (Inhibit, Shift, Emotional Control, Self-Monitor). Analysis of clinically significant reported problem areas (i.e., scale T-scores  $> 65$ ) revealed that caregivers were more likely than patients to endorse clinically significant problems across all cognitive and behavioral/emotional scales (all  $p$ 's  $< .05$ ). Nonetheless, rank-ordering of problem areas showed that patients and caregivers rate Working Memory as most problematic and Organization of Materials as least problematic.

**Conclusions:** Results suggest that the BRIEF-A identifies areas of EF complaints after TBI, but patients and caregivers may differ in degree and type of EF problems identified. Future studies should investigate whether caregiver burden or patient awareness may contribute to observed rater discrepancies.

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#### K. KIT, C. MATEER, J. RODGERS & H. TUOKKO. The Influence of Negative Stereotypes and Beliefs on Neuropsychological Test Performance in a Traumatic Brain Injury Population.

**Objective:** Research in social psychology has shown that the presence of stereotypes in testing environments negatively interferes with test per-

formance. However, the role of negative expectations/stereotypes on neuropsychological test performance in a TBI population has yet to be thoroughly investigated. Reminders of potential cognitive deficits are oftentimes present in neuropsychological testing settings (e.g., in advertisements recruiting participants, pre-test instructions, consent forms, and face-valid cognitive tests). It is argued that these cues exacerbate pre-existing negative beliefs, affecting cognitive test performance.

**Participants and Methods:** 42 individuals who sustained a mild-to-moderate TBI and 42 healthy control adults participated in the study. This study, similar to other 'stereotype threat' research, consisted of 'reduced threat' and 'heightened threat' conditions. The purpose of the former condition was to reduce negative stereotypes (by indicating that mild-to-moderate TBIs do not necessarily lead to cognitive deficits and highlighting the idea that individuals have control over cognitive abilities). The heightened threat condition emphasized the notion of permanent cognitive deficits after a TBI. Questionnaires and neuropsychological tests were administered subsequent to the experimental manipulation.

**Results:** Statistical analyses revealed that head-injured individuals in the reduced threat condition outperformed head-injured individuals in the heightened threat condition on neuropsychological measures of encoding and attentional abilities. Regression analyses indicated that the construct of memory self-efficacy mediated the relation between threat condition and performance on encoding/attention measures.

**Conclusions:** The findings highlight the importance of social context (specifically, the role of negative stereotypes and expectations/beliefs) to test performance in TBI individuals, potentially informing practice in neuropsychological testing environments and rehabilitation settings. Correspondence: Karen Kit, M.A., University of Victoria, PO Box 3050 STN CSC, Victoria, BC V8W 3P5, Canada. E-mail: kkit@uwic.ca

#### D. LABBE & T. NOVACK. Qualitative aspects of return to driving following traumatic brain injury.

**Objective:** The percentage of people who return to driving following severe TBI is estimated to be 40-60%. Little is known, however, about the qualitative aspects of driving following TBI such as the avoidance of specific driving conditions and exposure (frequency and distance).

**Participants and Methods:** A total of 127 TBI survivors (66.7% male, 64.3% Caucasian) were interviewed at 1, 2, or 5 years post-injury. Average age and education at the time of injury was 35.2 (range 17 to 80) and 12.0 years (range 5 to 20), respectively. The sample was moderately to severely injured (mean GCS: 7.3, 76%  $< 13$ ).

**Results:** In this sample, 56.2% returned to driving, well below the national proportion in which 88% of people aged 15 and older drive (National Household Travel Survey, US Dept. of Transportation, Bureau of Transportation Statistics, 2001). At 1, 2, and 5 years after injury 53.9%, 59.5%, and 59.1% of this sample reported a return to driving suggesting this most often occurs in the first year after injury. Whereas the average driver in the US drives over 200 miles per week, 59% of the TBI sample drove less than 100 miles per week with 58.6% reporting less frequent driving compared to pre-injury. 50.8% of the TBI sample avoided at least one common driving situation, most frequently bad weather (38.9%) and night driving (25.4%).

**Conclusions:** These results suggest previous findings of minimal additional risk of crash post-TBI may be partly explained by self imposed avoidance and limited exposure.

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#### R.T. LANGE, J. BRUBACHER, G.L. IVERSON, R. PROCYSHYN & S. MITROVIC. Differential Effects of Alcohol Intoxication on S100B Levels Following Traumatic Brain Injury.

**Objective:** The severity of traumatic brain injury (TBI) is often classified by using Glasgow Coma Scale (GCS) scores and duration of post-traumatic amnesia (PTA). Alcohol intoxication can potentially adversely affect the reliability of these measures. The purpose of this study is to evaluate the role of the protein S100B as a biochemical marker for evaluating brain injury in the presence of alcohol intoxication.

**Participants and Methods:** Participants were 160 patients who presented to a large urban Level 1 Trauma Center in Canada. Patients were classified into four groups [Medical Controls (MC), Trauma Controls (TC), Mild TBI (MTBI), and Definite TBI (DTBI)] and two alcohol intoxication groups (i.e., Sober and Intoxicated). Blood samples were collected within eight hours of injury. Measures of S100B concentration were obtained using a commercially available assay kit (Sangtec 100 Elisa).

**Results:** For patients who were sober at the time of injury, significant differences in S100B levels were found across all four groups (i.e., DTBI > MTBI > TC > MC; all  $p < .05$ ). For patients who were intoxicated at the time of injury, there were few differences between groups (i.e., MC < MTBI & DTBI,  $p < .05$ ). In the TBI groups, alcohol intoxication was associated with significantly lower S100B values when compared to their sober counterparts (TBI-Sober > TBI-Intox,  $p < .05$ ).

**Conclusions:** Consistent with previous research, there was an association between S100B levels and TBI. However, S100B was not a useful biomarker in patients who were intoxicated with alcohol.

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**R.T. LANGE, J. BRUBACHER, G.L. IVERSON, B. MAEDLER & M. HERAN. Diffusion Tensor Imaging as a Predictor of Post-concussion Symptoms Following Mild Traumatic Brain Injury.**

**Objective:** Diffusion tensor imaging (DTI) is a relatively new MRI technique that promises different insights into white matter changes in the brain compared to CT or conventional MRI scans. The purpose of this study is to examine the relationship between post-concussion symptom reporting and white matter integrity of the corpus callosum following mild traumatic brain injury (MTBI).

**Participants and Methods:** Participants were 30 patients who presented to a Level 1 Trauma Center in Vancouver, Canada (16 MTBI and 14 Trauma Control [TC]). DTI of the corpus callosum was undertaken using a Phillips 3T scanner at 6 weeks post injury. Regions of interest were the genu, body, and splenium. Participants also completed a post-concussion symptom checklist. The MTBI group was divided into two groups based on DSM-IV Category C symptom criteria for post-concussional disorder (PCD): PCD (n = 9) and PCD Absent (n = 7).

**Results:** Subjects who sustained MTBIs reported more symptoms than the TC group ( $p = .034$ ; Cohen's  $d = .83$ ). There was a significant difference in Mean Diffusivity (MD) in the splenium ( $p = .005$ ;  $d = 1.16$ ) but not on other DTI measures (MTBI > TC). However, there were medium to large effect sizes in fractional anisotropy (FA) and MD in the body ( $d = .59$  and  $d = .63$ ), and MD in the genu ( $d = .49$ ). In the MTBI group, there were no significant differences between groups on all DTI measures. However, large effect sizes were found in MD in the genu, body, and splenium (range:  $d = .75$  to  $d = .94$ ). Logistic regression analyses correctly classified 62.5% to 68.8% of patients in the two PCD groups using FA, and 71.4% to 85.7% of patients using MD.

**Conclusions:** These results suggest that there may be an association between reduced white matter integrity in the corpus callosum and self-reported post-concussion symptoms 6 weeks post MTBI. However, further data is required to establish the reliability and clinical relevance of these findings.

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**M.J. LARSON, D.A. KAUFMAN & W.M. PERLSTEIN. Conflict Adaptation and Cognitive Control Adjustment Following Severe Traumatic Brain Injury.**

**Objective:** Survivors of severe traumatic brain injury (TBI) often demonstrate impairments in the cognitive control functions of detecting re-

sponse conflict and signaling for recruitment of cognitive control resources to appropriately adjust performance. These cognitive control processes can be measured by examining conflict adaptation effects on behavioral performance and brain activity, wherein manifestations of conflict detection and processing are altered following high- relative to low-conflict trials.

**Participants and Methods:** Event-related potentials (ERPs) were acquired while 19 severe traumatic brain injury (TBI) survivors and 21 demographically-matched, neurologically-normal controls performed a single-trial, color-naming Stroop task. The incongruent minus congruent trial Stroop effect for trials preceded by incongruent (high conflict) and congruent (low conflict) trials were examined for behavioral (i.e., response time [RT] and error rate) and electrophysiological reflections of cognitive control.

**Results:** Control and TBI participants showed similar-magnitude reductions of the Stroop effect as reflected in RTs when current trials were preceded by incongruent trials. This effect was not attributable to repetition priming. ERPs revealed a tonic conflict slow potential, beginning around 600ms post-stimulus, that differentiated incongruent from congruent trials and was larger in magnitude for control than TBI participants. Planned comparisons revealed a decreased amplitude conflict SP when preceded by incongruent trials in control, but not TBI participants.

**Conclusions:** Results indicate impaired electrophysiological reflections of putative conflict resolution and signaling mechanisms in the context of intact RT-related conflict adaptation effects in survivors of severe TBI. Future research elucidating the behavioral correlates and real-world manifestations of such neural changes is discussed.

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**T. LEE-WILK, P. DISCHINGER, M. DUX, J. KUFERA, O. VAN ORDEN, K. AUMAN, K. MURDOCK & R.L. KANE. Comparison Of The ARES For Palm OS Handheld PDA And ANAM Computerized Test Platforms In Mild Traumatic Brain Injury.**

**Objective:** The Automated Neuropsychological Assessment Metrics (ANAM™) is a computerized library of neuropsychological tests designed for repeated evaluations. The ARES (ANAM™ Readiness Evaluation System) is a cognitive test system designed for operation on palm OS Personal Digital Assistants (PDA). It uses similar tests as the ANAM™ system configured for the PDA. Test data obtained from the two platforms have been shown to be significantly correlated though differences in absolute scores exist. The current study was conducted to assess the relationship between similar tests administered via different platforms (PDA and notebook) to patients with mild traumatic brain injury (mTBI).

**Participants and Methods:** Participants (N=80), ages 18-64, were recruited from an urban hospital trauma center following mTBI. Participants were administered the ANAM™ at 7-10 days and 3, 6, and 12 months post injury. They were also administered the ARES on day 7-10 post injury. Both tests were administered within an hour. Correlations were used to determine the relationship between summary scores on three overlapping tests: 1. Sleep Scale (SS), a self-assessment of sleepiness during evaluation; 2. Simple Reaction Time (SRT), a test of simple reaction time; 3. Running Memory Continuous Performance Task (CPT), a test of sustained attention and working memory.

**Results:** Results indicated significant relationships between ARES and ANAM™ variables: ARES and ANAM™ CPT-throughput ( $r^2 = 0.65$ ,  $p < .0001$ ); ARES and ANAM™ SRT-throughput ( $r^2 = 0.52$ ,  $p < .0001$ ); ARES and ANAM™ Sleep Scale ( $r^2 = 0.43$ ,  $p = .0002$ ).

**Conclusions:** Findings indicate while ARES and ANAM™ tests were significantly correlated, they were not strong enough to support using the measures interchangeably.

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**J. LENGENFELDER, G. WYLIE, A. SMITH, H. GENOVA, N. CHIAR-AVALLOTTI, J. LIU & J. DELUCA. Using fMRI to Examine Verbal Learning in Individuals with Traumatic Brain Injury.**

**Objective:** To examine verbal learning in individuals with TBI using fMRI. **Participants and Methods:** Participants were 13 individuals with moderate-severe TBI and 10 healthy controls (HCs). Subjects learned two word lists while in the scanner. Similar to the CVLT, each list was composed of 16 words (4 words in 4 categories). The first word list was randomly presented without provision of a learning strategy. The second word list was grouped according to semantic category and subjects were instructed to use the grouping strategy to learn the list. AFNI was used to examine group differences. T-tests ( $p < .005$ ) were run to identify brain regions significantly more or less active in individuals with TBI compared to HCs for each list.

**Results:** Comparison of patterns of cerebral activation while learning the first list (unstructured list of words) demonstrated that individuals with TBI showed greater activation in frontal regions than HCs. However, no significant differences between the groups were noted in the same frontal regions during learning the second list, when subjects were provided with an organizational strategy.

**Conclusions:** Increased activation in frontal regions for individuals with TBI when learning an unstructured word list indicated that they required greater cerebral resources during the task compared to HCs. However, once the information was semantically organized to maximize learning, those areas which had demonstrated increased activation in persons with TBI was no longer significantly different from HCs. These findings could contribute to understanding learning problems following TBI and help develop rehabilitation strategies to improve new learning.

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**S.M. LIPPA, H.J. HANNAY & L. STEINBERG. THE LARRABEE (2008) CRM TEST MALINGERING FORMULA: DOES IT PRODUCE FALSE POSITIVES IN CONSECUTIVELY ADMITTED SAMPLES OF SEVERE/MODERATE AND COMPLICATED MILD TBI PATIENTS WITH/WITHOUT A LAWSUIT AT 6 MONTHS POST INJURY?**

**Objective:** Larrabee (2008) created a formula for detecting malingering with the Continuous Recognition Memory (CRM) Test based on a comparison of the item by item performance of litigating patients suspected of malingering and litigating/non-litigating severe/moderate TBI patients in his practice. The current research determined if the formula would produce a similar false positive rate in trauma center consecutively admitted samples of severe/moderate and complicated mild TBI patients with/without a lawsuit.

**Participants and Methods:** A sample of 118 consecutively admitted severe/moderate and complicated mild TBI patients completed the CRM as part of a larger neuropsychological battery at 6 months post injury. The NYU HI-FI Follow-up Interview question about having a lawsuit for an injury was used.

**Results:** Average age was 30.8 yrs (SD = 13.5). Gender ratio was 4.9:1 males/females. Malingering scores were analyzed. The false positive rate was 17.8% for all groups. It differed significantly from the rate reported previously for non-litigating severe/moderate TBI patients ( $\chi^2 = 15.784$ ,  $p < .001$ ). No patients in litigation and 19.6% with no litigation (75% with severe TBI) obtained a formula score in the malingering range.

**Conclusions:** The Larrabee (2008) CRM Test formula for detecting suspected malingerers produced a false positive rate of 7.4% in his sample of litigating/non-litigating severe/moderate TBI patients. This formula produced 17.8% false positives when applied to performance of a series of consecutively admitted severe/moderate or complicated mild TBI patients with/without a lawsuit at 6 months post injury. Possible reasons why findings differed from Larrabee (2008) are discussed.

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**M. LIVENGOOD, J. ANDERSON & M. SCHMITTER-EDGECOMBE. Memory Self-Awareness Following TBI: Evaluating "Offline Assessment" And "Online Assessment" Methodologies.**

**Objective:** Awareness of abilities is important for a person's capacity to benefit from rehabilitation following traumatic brain injury (TBI). We examined memory self-awareness in individuals with moderate to severe TBI using both "offline assessment" (i.e., self-report) and "online assessment" (i.e., performance prediction paradigm) methodologies. While studies using "online assessment" methodology indicate that TBI participants demonstrate accurate memory self-awareness, studies using "offline assessment" methods generally suggest that TBI participants overestimate their memory abilities.

**Participants and Methods:** Metamemory was assessed in 19 moderate-to-severe TBI participants who on average were less than 6 months time since injury and 19 controls matched on age and education. Accuracy of the "offline assessment" involved contrasting patient self-ratings of their memory functioning with assessments from controls, patient ratings by knowledgeable informants and objective memory tests. Accuracy of "online assessments" was assessed by comparing the predicted amount of information recalled with actual memory performance on list-learning and visual-spatial memory tests.

**Results:** As expected, TBI participants displayed poorer recall for newly learned information and reported more memory difficulties through both methodologies than controls. However, no group differences were observed in the prediction accuracy of "offline assessments" and "online assessments" for objective memory tests. In addition, TBI participant's report of memory functioning was similar to ratings by knowledgeable informants.

**Conclusions:** Both assessment methods revealed that TBI participants were as accurate as controls in predicting their memory performance. As past research has suggested, the more individuals are aware of deficits, the more they are likely to benefit from rehabilitation.

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**C.D. MARQUEZ DE LA PLATA, J. GRINNAN, J. GARCES, C. MOORE, K. GOPINATH, C.J. MADDEN, M.D. DEVOUS, SR., C.M. CULLUM & R. DIAZ-ARRASTIA. Structural and Functional Interhemispheric Connectivity after Traumatic Brain Injury.**

**Objective:** To determine whether measures of structural interhemispheric connectivity correlate to functional connectivity (fc) after traumatic brain injury (TBI).

**Participants and Methods:** Sixteen participants (10 patients and 6 controls) were recruited from Parkland Memorial Hospital in Dallas, Texas. Patients experienced a closed head injury with a mechanism consistent with diffuse axonal injury (DAI). Structural (T1 and Diffusion Tensor) and functional (resting state) MRI images were obtained using a 3T Siemens scanner 6-11 months post-injury. The corpus callosum (CC) was reconstructed using a fiber tracking protocol. Bilateral hippocampal seed voxels were identified for each subject. Target ROI masks for the entire brain, contralateral hemisphere, and contralateral hippocampi were drawn to determine the number of voxels functionally related to activity in seed ROIs. Neurocognitive outcomes were assessed at the time of the MRI.

**Results:** Between group tests showed there were no age or gender differences between patients and controls. Spearman's correlations showed positive associations between the length of CC tracks and degree of interhemispheric fc (i.e., fc with the homologous contralateral hippocampus and the contralateral hemisphere) when using either left and right hippocampi as independent seeds. Psychomotor speed was positively correlated with degree of interhemispheric fc when using either hippocampus as seeds. Additionally, interhemispheric fc from both hippocampi showed a negative association with a working memory task, such that greater degree of contralateral involvement coincides with poorer working memory ability.

**Conclusions:** The results provide preliminary evidence that a relatively novel measure of structural connectivity is associated with functional connectivity, such that degree of injury to interhemispheric white matter is associated with a pattern of impaired interhemispheric functional connectivity and impairment in neurocognitive outcome 6 months post-TBI.

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**S. MCDONALD & B. ADAMS. Deficits in Social Problem Solving following Traumatic Brain Injury: Are they related to Theory of Mind, Emotion Identification and Executive Functioning.**

**Objective:** Poor problem solving is common after severe Traumatic Brain Injury (TBI) as is poor social functioning. The question arises as to whether deficits in social problem solving reflect deficits in information processing (social cognition) or reflect more generic executive dysfunction. This study investigated whether adults with TBI demonstrated social problem solving deficits on the Assessment of Interpersonal Problem Solving Skills (AIPSS) relative to control participants. It also examined the relationship between social problem solving skills, theory of mind (ToM), emotion identification and executive functioning.

**Participants and Methods:** 14 individuals (11M,3F) aged 39.8(sd 11.4) years, with 13.5(sd 3) years education who had sustained a severe TBI (PTA = 98 (sd = 68.1) days) or 11.1 (sd = 6.7) years ago, and 14 healthy individuals (11M,3F) aged 38.2 (sd = 11.2) years with 13.8 (sd 3.3) years education.

Participants were tested on: social problem solving (AIPSS), ToM (Mind in the Eyes), emotion recognition (Ekman faces), and executive function (Verbal fluency, Hayling test, Trails, Matrix Reasoning).

**Results:** The TBI group performed more poorly than controls on the AIPSS. Within this task they were better able to identify that a problem existed, than they were able to determine how best to solve the problem to the satisfaction of the protagonists. Control participants showed no difference between these two abilities. Participants with TBI were also impaired on measures of ToM, emotion identification and executive function. Results indicated the TBI group's performance on the AIPSS was not correlated with ToM, emotion identification or executive functioning, while these abilities were correlated for controls.

**Conclusions:** The results of this study suggest that social problem solving is multifaceted. While different components of social cognition and generic executive functions appear to contribute to social problem solving in normal adults, this relationship breaks down following severe TBI. Correspondence: *Skye McDonald, PhD, School of Psychology, University of NSW, UNSW, Sydney, NSW 2052, Australia. E-mail: s.mcdonald@unsw.edu.au*

**T. MCHUGH, A. TELLIER, S.C. MARSHALL, K.G. WILSON, A. SMITH, M. PERUGINI & I.G. STIELL. Predictive Value of the Neurobehavioral Functioning Inventory (NFI) in Mild Traumatic Brain Injury: A Front-line Measure to Identify Those in Need of Intervention.**

**Objective:** Although the cognitive and emotional effects of a mild traumatic brain injury (mTBI) typically resolve without complication, 10 to 20% of patients experience persistent symptoms (Alexander, 1995; Ruff, 2005). The early identification of postconcussion syndrome patients from their asymptomatic counterparts has been challenging and the large number of mTBI patients makes routine testing unfeasible. The purpose of the present study was to assess the ability of the Neurobehavioral Functioning Inventory (NFI), a measure that is easy and quick to administer, to identify those at risk of experiencing symptoms beyond the subacute phase.

**Participants and Methods:** A sample of 141 mTBI patients (mean age of 36.8 years [SD=14.1] and education of 14 years [SD=2.3]) was

followed up to one year post-injury (final n=66). At one-month post-mTBI, the NFI and measures of working memory, multi-tasking, and processing speed were administered. The Beck Depression Inventory-II and SF-36 Health Survey - Mental Health scale were also used as outcome measures at the one-year mark.

**Results:** Results showed that: i) the NFI-memory scale was a good indicator of concurrent cognitive impairment at one month post-mTBI ( $r = -.32$  to  $-.24$ ,  $p < .001$ ); ii) the NFI-depression scale was a good predictor of mood ( $r = .58$ ,  $p < .001$ ) at 12 months; and iii) NFI depression subscale was more predictive of outcome at 12-months ( $\beta = -.84$ ,  $t(57) = -5.79$ ,  $p < .001$ ) than age, marital status, or cognitive performance (all with a  $p$  value  $> 0.1$ ).

**Conclusions:** In summary, front-line clinicians could use the NFI to identify "at risk" mTBI patients and provide early intervention and adequate follow-up to those in need.

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**P. ROSKOS, J.D. GFELLER & G.J. ERKER. The Effect of Depression on Cognitive Screening and Functional Outcome in Traumatic Brain Injury (TBI) Patients.**

**Objective:** Depression occurs commonly in persons with TBI. Research regarding the effects of depression on performance on measures of cognition has been mixed, with some studies finding an adverse impact of depression on cognition, while others find no significant impact. Research has also demonstrated that depression may adversely affect functional status following brain injury rehabilitation. This study examined the impact of depression status on performance on measures of cognitive screening (NCSE and MMSE), both assessed within one week of admission to an inpatient rehabilitation unit. The influence of depression status on functional ability at discharge (FIM Scores) was also explored.

**Participants and Methods:** Archival data were used and participants included TBI patients at an urban neurorehabilitation unit. Participants (N=149) generally had moderate-to-severe TBIs due to a variety of etiologies. Data were obtained from two sources: (1) the Uniform Data System for Medical Rehabilitation (UDSMR) and (2) archived scores from cognitive screening and self-report depression measures maintained by the neuropsychology service.

**Results:** Results showed no significant differences based on level of depression (none, mild, moderate, or severe) in patients' performance on cognitive screening measures or on discharge functional status.

**Conclusions:** These findings are consistent with some studies that found no relationship between depression severity and neurocognitive functioning. Possible moderating factors, such as psychosocial support during hospitalization, may have contributed to the non-significant relationship between depression and discharge functional status. Additionally, depression may have less impact during acute rehabilitation when compared to functioning further post discharge.

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**P. ROSKOS, J.D. GFELLER & G.J. ERKER. Use of the Geriatric Depression Scale With Younger and Older Adult Traumatic Brain Injury (TBI) Patients.**

**Objective:** A variety of measures have been used to screen for depression in TBI patients, including the Centers for Epidemiological Studies Depression Scale and the Beck Depression Inventory. The Geriatric Depression Scale (GDS) is another measure that has been used with diverse conditions, but few studies have examined its use with TBI patients. Although originally intended for use with older adults ( $\geq 65$ ), the GDS has been applied across the age spectrum (17-55 and  $\geq 65$ ). Based on established validity with multiple patient populations and across adult age groups, it was hypothesized that the GDS would be a useful depression measure with adult TBI patients.

**Participants and Methods:** Archival data were used and participants included TBI patients at an urban neurorehabilitation unit. Data were obtained from two sources: (1) the Uniform Data System for Medical Rehabilitation (UDSMR) and (2) archived GDS scores maintained by the neuropsychology service. Patients were divided into non-depressed, mildly depressed, and severely depressed groups of older ( $\geq 65$ ) and younger adults (18–64).

**Results:** Results showed mean GDS scores for younger and older adults consistent with previous literature. No significant differences between younger and older adults were observed on GDS score, suggesting that scores did not vary across age groups. Significant differences were found between non-depressed, mildly depressed, and severely depressed groups, indicating that the GDS accurately differentiated levels of depression severity regardless of age.

**Conclusions:** These results extend existing research involving the GDS and support its use with adult TBI patients.

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#### **K. RUSSELL, J.M. SCANLON, P.M. ARENTH & J.H. RICKER. Lower Level Language Deficits After Traumatic Brain Injury.**

**Objective:** Traumatic Brain Injury (TBI) can impact multiple areas of cognition, including language. While current literature shows a strong focus on impairments at the discourse level of language processing, it is not clear in what cases word and sentence level processing are similarly impaired. The current project was thus designed to investigate subtle changes in lower level language processing after TBI.

**Participants and Methods:** Multiple subtests adapted from classic psycholinguistic experiments were chosen that target different types of language information, including orthographic, phonological, semantic, syntactic, and morphological. This battery of tests was given to 12 persons who have experienced a TBI and 12 controls matched for age, gender, and years of education. All participants were right-handed native English speakers, and reported no history of neurological disease or insult, alcohol/drug abuse, or psychological disorders. Participants with TBI experienced a traumatic brain injury within the past 1–3 years that was classified as either moderate, severe, or complicated mild (mean initial Glasgow Coma Score = 5.6).

**Results:** While a few tests did find differences between the two groups, the overwhelming result is that both groups showed similar patterns of responding (generally with a faster response rate for the control group). When taken as individuals, however, the patterns of some subjects suggest that they may have specific difficulties using one type of language information across multiple subtests, such as semantics or orthography.

**Conclusions:** These results support the idea that although persons with TBI may appear not to have any language impairment in group comparisons, individuals may be affected in regular ways.

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#### **A.L. SHANDERA, J. CLARK, J. HARP, R. SCHLEENBAKER & W.M. HIGH. Psychological Profiles of Combat Veterans Exposed to Mild Head Trauma and Combat-Related Stressful Events: Preliminary Findings.**

**Objective:** Many veterans are returning with symptoms of PTSD and mild traumatic brain injury (mTBI) resulting from blasts and other combat. It was hypothesized that the MMPI-2 PTSD scale (PK) would differentiate between mTBI veterans who met DSM-IV-TR criteria for PTSD and those who did not. In addition, group differences on screens for: PTSD (PCL-C), anxiety (BAI), depression (BDI), and overall stress (PSS) were examined.

**Participants and Methods:** Twenty recent combat veterans were referred for neuropsychological evaluation following possible mTBI and combat-related stress. Of these, 1 lacked evidence of brain in-

jury, 2 invalidated the MMPI-2, and 2 failed a test of effort (LMT). Of the remaining 15 veterans, (15 Caucasian, 14 males), all had reported injuries with either a loss or alteration of consciousness. All participants were given an extensive clinical interview, neuropsychological test battery, emotional/behavioral measures, and a PTSD screen.

**Results:** Based on DSM-IV-TR guidelines, 73.3% of the sample met criteria for PTSD. T-tests indicated that the PTSD group had significantly greater elevations on scales 1, 4, 7, and 8. Significant differences in mean scores on PK were found between groups, but the recommended cutting score only identified 18% of those with PTSD. A cutting score of 50 on the PCL-C correctly identified 91% of the PTSD group. Group differences on other screening measures are discussed.

**Conclusions:** These results suggest that recommended cutting score for the PCL-C provides greater sensitivity to PTSD than the current PK cut-off. In addition, history of mTBI may alter the MMPI-2 profile. The potential for new cutting scores is discussed.

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#### **P. SHORE, S. TUN, A. JOHNSON, T. DEMADURA & D. STORZBACH. Preliminary Findings on Neuropsychological Correlates of Self-Reported Cognitive Impairment Among OIF/OEF Combat Vets with Exposure to Blasts.**

**Objective:** Fifty-nine percent of the injured Operation Iraqi Freedom (OIF)/Operation Enduring Freedom (OEF) veterans had been found to have combat-related mild traumatic brain injury (MTBI). Furthermore, combat exposure may result in psychological problems, including PTSD. Patients with PTSD often report symptoms similar to patients with MTBI. Research in civilian populations has shown that neuropsychological and psychiatric dysfunction can interact in such a way as to create further impairment in cognitive functioning. Memory and attention are the most common deficits, and are also the most strongly associated with TBI and PTSD. The current study explored the relationship between self-reported cognitive impairment in memory and attention and their neuropsychological test performance among OIF/OEF blast-exposed combat vets.

**Participants and Methods:** Fifteen participants with history of blast exposure were drawn from a larger study at the Portland VA Medical Center. As part of a more comprehensive battery, participants completed the Ruff Neurobehavioral Inventory (RNBI) as a measure of subjective cognitive complaints and the Neuropsychological Assessment Battery (NAB) Memory Module and Attention Modules.

**Results:** Pearson correlation analysis showed significant relationships between the RNBI Attention & Concentration Scales and select NAB Memory Module subtests, and between RNBI Learning & Memory Scale and select NAB Attention Module subtests; however, other neuropsychological test performances were not related to patient's self-reported cognitive impairment.

**Conclusions:** The cognitive impairment consistent with psychiatric effects of exposure to combat may be more prominent than the neuropsychological effects of MTBI. However, it remains unclear whether ecological validity in neuropsychological testing plays a role in the discrepancy.

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#### **G.M. THORNTON, J.F. BENGE, R.E. DARROW & N.J. PASTOREK. Relation Between Postconcussive Symptoms, Brain Injury Severity Characteristics, and Posttraumatic Stress in OEF/OIF Veterans.**

**Objective:** Traumatic brain injury has been identified as the signature wound of the wars in Afghanistan and Iraq (OEF/OIF). Although the majority of these brain injuries are mild by contemporary classification standards, veterans frequently continue to report significant postconcussive symptoms (PCS) months to years post-injury. Confounding the

interpretation of PCS symptoms is an incomplete understanding of how injury severity characteristics and comorbidities such as PTSD impact these self-reports. This study was designed to explore the relation between PCS symptoms, injury severity characteristics, and PTSD in OEF/OIF veterans.

**Participants and Methods:** 175 OEF/OIF veterans completed the PTSD Checklist and the Neurobehavioral Symptom Inventory (NSI), a measure of PCS. Additionally, injury severity characteristics including presence or absence of LOC, time since initial injury, and number of injuries were collected. Linear regressions were utilized to examine the relation of these three factors to PCS report, both alone and after accounting for PTSD symptoms.

**Results:** Presence of LOC was associated with somatic symptoms and headaches, as well as cognitive symptoms to a lesser extent. After accounting for PTSD, LOC remained significantly associated with both somatic symptoms and headaches. Time since initial injury was associated with affective symptoms after controlling for PTSD symptoms. In all models, PTSD symptoms accounted for the majority of explained variance.

**Conclusions:** Injury severity characteristics were associated with a subset of PCS symptoms, although PTSD explained a considerably larger amount of the variance in PCS report. Results underscore the need for interdisciplinary teams to carefully evaluate PTSD symptoms when evaluating and treating PCS.

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**J. TINKER, P. SCHATZ, M. GIBNEY, J. BROOKS & E. ZILLMER. The Relationship between Reported Visual Disturbance and Post-Concussion Cognitive Function in Collegiate Athletes.**

**Objective:** A current trend within the sports-related concussion research community is focused on the investigation of the relationship between post-concussive symptomatology and neurocognitive performance. The current investigation expands upon this literature by examining the relationship between reported visual disturbance and neurocognitive performance on computerized assessment in collegiate athletes.

**Participants and Methods:** Participants included a total of 57 Drexel University athletes who sustained concussions over the course of a two-year evaluation period. All athletes were administered pre-season baseline Immediate Post-Concussion Assessment and Cognitive Testing (IMPACT) as well as post-concussive testing within 48 hours of injury.

**Results:** A mixed factorial design revealed a main effect of time,  $T^2 = 61.05$ ,  $F_6, 50 = 9.21$ ,  $p < .001$ , main effect of group,  $T^2 = 21.18$ ,  $F_6, 50 = 3.21$ ,  $p = .01$ , and an interaction between assessment time and visual problem report,  $T^2 = 16.01$ ,  $F_6, 50 = 2.43$ ,  $p = .039$ . Results revealed significant decline from baseline in the post-concussive group. Group comparison revealed significantly greater declines over time for those athletes who reported visual symptoms, particularly in the domains of visual motor speed and reaction time, as well as increased overall symptom report.

**Conclusions:** Results suggest a greater degree of severity of concussion in those athletes who report visual symptoms post-concussively in comparison to their non-visual-symptom reporting counterparts, both in terms of neurocognitive decline and increased symptom report. The potential for symptom report, and specifically the report of visual problems post concussively, to serve as a useful basic heuristic in return-to-play decision-making is promising.

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**O.R. VAN ORDEN, T. LEE-WILK, P.C. DISCHINGER, J.A. KUFERA, B. BALDWIN, K.A. AUMAN, K.R. MURDOCK & R.L. KANE. Performance on a Computerized Measure of Attention as a Predictor of Persistent Cognitive Symptoms Following Mild Traumatic Brain Injury. Objective:** Following mild traumatic brain injury (mTBI), cognitive symptoms typically resolve by three months. However, persistent cog-

nitive complaints may be associated with female gender, age, socioeconomic status, alcohol abuse, and prior TBI. The current study assessed whether certain demographic variables and/or performance on a computerized measure of attention predicted persistent cognitive complaints in mTBI.

**Participants and Methods:** The Automated Neuropsychological Assessment Metrics (ANAM™) is a computerized library of neuropsychological tests. Individuals were assessed with the ANAM™ Running Memory Continuous Performance Test (CPT) 7 to 10 days post injury. Self-reported cognitive symptoms were assessed at three months (N=55) and 12 months (N=74) following injury.

**Results:** Logistic regression showed that the predictors reliably distinguished between participants reporting the presence cognitive symptoms and those without cognitive symptoms at three months post-injury [ $\chi^2(6, N = 55) = 16.72$ ,  $p = .01$ ]. Of these, sex, previous TBI, and CPT performance significantly predicted the presence of cognitive symptoms: female gender [ $\chi^2(1, N = 55) = 5.56$ ,  $p = .018$ ], a previous TBI [ $\chi^2(1, N = 55) = 4.54$ ,  $p = .033$ ], and poorer CPT performance at 7 to 10 days following injury [ $\chi^2(1, N = 55) = 4.57$ ,  $p = .033$ ] were related to cognitive symptoms at three months following injury. These effects did not persist at 12 months post injury.

**Conclusions:** Factors present post-injury, including performance on a computerized measure of attention, predicted persistent cognitive symptoms during the early recovery period in mTBI.

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**W. WATSON, A. GREENFEDER, J. ALBERTO, J. WISHIN, J.H. HANNAY & S.C. HEATON. The Relationship between Early Glasgow Coma Scale (GCS) Scores and Later General Functional and Cognitive Outcome in Adult Severe Traumatic Brain Injury (TBI).**

**Objective:** The GCS is a rating system used to quantify level of consciousness following TBI. Although the GCS has proven useful in predicting mortality and global functional outcome, few studies have examined its relationship to cognitive outcome (i.e. working memory). The aim of this study was to assess the correlation between acute GCS scores (days 7 and 14 post-injury) and sub-acute (3 months post-injury) general functional and cognitive outcome.

**Participants and Methods:** GCS scores and outcome data were obtained on 32 adults, ages 18-81, who sustained a severe TBI.

**Results:** Data analysis showed no statistically significant correlation between GCS score of day 7 survivors and their mortality status at 3 months ( $r_{pb} = -.07$ ,  $p = .70$ ). Furthermore, of those patients who survived 3 months ( $n = 20$ ), day 7 GCS scores did not correlate with Glasgow Outcome Scale-Extended (GOS-E) nor with Wechsler Adult Intelligence Scale (WAIS-III) Digit Span. However, there was a significant positive correlation between day 14 GCS scores and general functional outcome as measured by the GOS-E ( $r = .65$ ,  $p < .001$ ). Moreover, for those patients who were functionally able to complete neuropsychological testing at 3 months ( $n = 12$ ), results showed a significant positive correlation between day 14 GCS scores and cognitive outcome at 3 months as determined by the Digit Span subtest ( $r = .65$ ,  $p < .05$ ).

**Conclusions:** Current study findings suggest that GCS scores obtained in the first week post-injury do not offer significant information regarding possible later overall outcome. However, GCS scores obtained later during hospitalization may provide useful information regarding subacute general and cognitive functioning among survivors of severe TBI.

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**K. WHITFIELD, D. COX, D. BERNSTEIN & A. THORNTON. Self-reported Concussion Exposure Predicts Neurocognition in Elite Athletes.**

**Objective:** This study evaluated the relative capacity of two self report indices of concussion exposure to predict long term neurocognitive performance in athletes. Neurocognitive performance was predicted by 1) the cumulative sum of duration of confusion associated with all Grade 2 and 3 concussions, and 2) a simple count of the reported number of these concussions.



**Participants and Methods:** Neurocognition and self reported concussion history were assessed in 28 elite rugby players. Neurocognition was evaluated by the CogSport Computerised Test Battery, which yields measures of Response Speed, Accuracy and Consistency across subtests of Memory, Problem Solving, Decision Making and Psychomotor Functions. Players reported their concussion history and length of acute confusion for each concussion experienced by completing the Sport-Related Head Injury Questionnaire (SHIQ).

**Results:** When severity of concussion exposure was indexed by the cumulative sum of the reported duration of acute post injury confusion, increased exposure predicted only Response Speed slowing. In contrast, when severity of concussion exposure was indexed by simply counting the number of Grade 2 and 3 concussions reported, increased exposure predicted both Response Speed slowing and reduced Response Consistency.

**Conclusions:** Retrospective reports of the number of Grade 2 and 3 concussions incurred predicted broader aspects of neurocognition than did the cumulative duration of all post concussion confusion. Thus, in elite athlete samples, simple self-reported concussion counts may be employed to evaluate dose-response relationships between concussion exposure and long term neurocognitive functioning. These results contradict research (e.g. Collie et. al., 2006), that reports no association between performance on the CogSport and concussion history.

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**A.S. YI, S.M. BELKONEN, C.I. HIRSHSON & J.B. CANTOR. WAIS-III Vocabulary: Is it a valid test of premorbid intellectual functioning for older adults with traumatic brain injury (TBI)?**

**Objective:** The WAIS-III Vocabulary subtest is generally considered a cognitive measure resistant to decline over the lifespan and is often used to estimate premorbid intellectual functioning. This study investigates the usefulness of the WAIS-III Vocabulary subtest as a measure of pre-injury function for older adults with traumatic brain injury (TBI).

**Participants and Methods:** Participants were adults 55 years and older and were recruited at a large urban hospital. 72 participants had a history of TBI. 50 participants had no history of TBI. Participants were administered a standard neuropsychological battery as part of a larger study of aging after TBI.

**Results:** No significant differences were found between the groups on years of education, ethnicity, gender, or age ( $p > .20$ ). Participants with no history of TBI had significantly higher scores on the WAIS-III vocabulary subtest when compared to participants with TBI ( $p = .003$ ).

**Conclusions:** Findings suggest that the scores on the WAIS-III Vocabulary subtest may decline after a TBI for older adults. Therefore, it may not accurately measure premorbid intellectual functioning after a TBI for older adults. Prospective longitudinal research is needed to test this hypothesis.

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**R.O. TEMPLE, D.J. ZGALJARDIC, B.C. ABREU, G.S. SEALE, G.V. OSTIR & K.J. OTTENBACHER. Relationship Between the Neuropsychological Assessment Battery Screening Module (NAB-SM) and Functional Independence in Post-Acute Brain Injury Rehabilitation.**

**Objective:** Cognitive impairment secondary to traumatic brain injury can greatly limit an individual's functional independence. The aim of the current study was to explore the relationship between a relatively new neuropsychological screening battery (NAB-SM) and an established measure of functional independence (FIM instrument) in a sample of individuals with traumatic brain injury.

**Participants and Methods:** Seventy individuals with moderate to severe traumatic brain injury at a residential post-acute rehabilitation facility completed the FIM instrument and the NAB-SM upon admission. Hierarchical regression analysis was used to examine the relationship between the variables from these two assessment measures.

**Results:** The NAB Total Screening score accounted for 26% of the variance in the FIM instrument Total Score, 11% of the variance in the FIM instrument Motor Subtotal score, and 53% of the variance in the FIM instrument Cognitive Subtotal score. The NAB-SM Spatial Domain score was uniquely predictive of FIM instrument Motor domain scores (self care, mobility, and locomotion) and Cognitive domains scores (social interaction) suggesting the specific role that spatial skills may have in motor functioning and nonverbal social communication/interaction. Overall, the current findings are consistent with previous work demonstrating a relationship between neuropsychological test performance and the FIM instrument, and extend these results by exploring the relationships with FIM instrument cognitive domain scores and subscores.

**Conclusions:** The current findings support previous research examining the relationship between cognitive and functional assessment measures and provide strong evidence for the ecological validity of the NAB-SM with regard to functional abilities as assessed by the FIM instrument. Correspondence: *Dennis J. Zgaljardic, Ph.D., Neuropsychology, Transitional Learning Center, 1528 Postoffice St., Galveston, TX 77550. E-mail: dzgaljardic@tlc-galveston.org*

**D.J. ZGALJARDIC & R.O. TEMPLE. Internal consistency and construct validity of the Neuropsychological Assessment Battery Screening Module (NAB-SM) in a sample of individuals with acquired brain injury (ABI).**

**Objective:** To provide preliminary data on the internal consistency and construct validity of the NAB-SM in a sample of individuals with ABI.

**Participants and Methods:** The sample consisted of 42 individuals (31 males, 11 females) admitted to a post-acute residential rehabilitation program with a history of moderate to severe ABI. Twenty-four participants were diagnosed with traumatic brain injury and 18 were diagnosed with cerebrovascular accident. The NAB-SM and a comprehensive neuropsychological test battery were administered separately within the first 2 weeks following admission. Statistical analyses included Cronbach's alpha and Pearson product moment correlations to assess the internal consistency and construct validity of the NAB-SM respectively.

**Results:** The NAB-SM cognitive domain index raw scores (Attention, Language, Memory, Spatial, and Executive) demonstrated weak internal consistency, whereas the NAB-SM Total index score demonstrated an adequate level. The NAB-SM index and subtest scores maintained several significant relationships with other neuropsychological tests that shared structure and content or not. These relationships were limited or absent when addressing the validity of the NAB-SM Executive subtests and the NAB-SM Shape Learning subtest.

**Conclusions:** Based on our preliminary findings the NAB-SM appears to be a valuable neuropsychological screening tool in a post-acute rehabilitation setting. However, when administering and interpreting the NAB-SM in patients with ABI one may consider (a) the value in the interpretation of NAB-SM individual subtest scores rather than NAB-SM cognitive index scores and (b) supplementing the NAB-SM with other tests assessing executive functions and nonverbal/visual memory.

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## Dementia (Subcortical, Specific Disorders, MCI, etc.)

**H. GROSSMAN & D. LIBON. Differentiation of MCI Subtype Using a Conceptual Composite Score on the Clock Drawing Test.**

**Objective:** The value of predicting clinical course in individuals at risk for developing dementia is widely acknowledged. In addition to determining the likelihood of conversion to dementia, the utility of prognostic differentiation of dementia subtype in individuals with mild cognitive impairment (MCI) is increasingly recognized. The aim of this study was to establish a brief assessment method to facilitate differentiation between MCI subtypes.

**Participants and Methods:** MCI participants were classified according to their domain of manifested impairment, yielding distinct amnesic (N = 14) and dysexecutive (N = 7) MCI groups. Performance on the clock drawing test was scored using a system that produced three distinct measures for both command and copy conditions: a composite score of conceptually based errors, a composite score of executive based errors, and a composite score of motor-related errors.

**Results:** Results indicated greater total errors in participants with dysexecutive MCI than those with amnesic MCI. In particular, dysexecutive

MCI participants exhibited a greater number of conceptually related errors on the clock drawing test than amnesic MCI participants across command and copy conditions, whereas performance was comparable between groups with respect to errors related to executive and motor functioning.

**Conclusions:** These findings support the efficacy of a conceptual composite score on the clock drawing test in differentiation of MCI subtype. Correspondence: *Henry Grossman, M.S., Psychology, Rutgers University, 152 Frelinghuysen Rd, Piscataway, NJ 08854. E-mail: henryja@hotmail.com*

## THURSDAY AFTERNOON, FEBRUARY 12, 2009

### Poster Session 4: Cancer, Epilepsy, Stroke/Aneurysm, MS/Demyelinating

1:15–2:45 p.m.

#### Cancer

C.L. SCHOFFSTALL, J.M. ASHFORD, W.E. REDDICK, C. LEONE, D. PEI, C. CHENG, C. PUI & H.M. CONKLIN. **Attention and Working Memory Abilities in Children Treated for Acute Lymphoblastic Leukemia.**

**Objective:** This study investigated attention and working memory (WM) abilities in survivors of childhood acute lymphoblastic leukemia (ALL). We also examined the separate contributions of attention and WM to IQ and their association with cerebral white matter changes.

**Participants and Methods:** Ninety seven children (55 males and 42 females) diagnosed with ALL were assigned to risk groups (low, standard, and high) based on comprehensive biological and clinical risk classification. During consolidation therapy, low-risk patients received intravenous methotrexate (IV-MTX) at 2.5 gm/m<sup>2</sup> plus triple intrathecal therapy every other week for 4 doses, whereas standard- or high-risk patients received 5.0 gm/m<sup>2</sup> together with intrathecal therapy. Patients were classified according to MRIs at the completion of consolidation therapy (normal or leukoencephalopathy) based on retrospective review by a single neuroradiologist. Children were assessed with the age appropriate Wechsler Intelligence Scale 2 years later (completion of therapy), utilizing Digit Span Forward (DSF) for attention and Digit Span Backward (DSB) for WM.

**Results:** For patients in the standard and high risk groups, DSF (p < .003), DSB (p < .0001), Total Digit Span (TDS; p < .001), and Full Scale IQ (FSIQ; p < .02) were impaired relative to the normative population. In the low risk group, only DSB was impaired (p < .0001). Across all groups, a significantly higher percentage of patients performed below the average range (scale score < 7) on DSB (66%) than DSF (15%) or TDS (18%). Regression analysis indicated that DSB predicted FSIQ (p < .005), even after taking into account the effect of DSF. Leukoencephalopathy was associated with lower TDS (p < .05).

**Conclusions:** WM appears especially sensitive to treatment related changes in children with ALL, detecting difficulties potentially missed by global intelligence measures. Identification of core cognitive deficits such as WM may facilitate identification of vulnerable neural pathways and development of targeted cognitive interventions.

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J.E. CARON, I.M. MOORE, M.J. HOCKENBERRY, N. JAIN, K.L. KAEMINGK & K.R. KRULL. **Oxidative stress and executive functioning in pediatric ALL patients undergoing chemotherapy.**

**Objective:** Neurocognitive and neurobehavioral sequelae following treatment for pediatric acute lymphoblastic leukemia (ALL) have been re-

ported in a significant proportion of long-term survivors. Although reduced use of cranial radiation has decreased the severity and frequency of such sequelae, patients treated with chemotherapy only are still at elevated risk. Early identification of children "at risk" for poor neurocognitive outcome is not yet reliable. Biological markers of oxidative stress (e.g., oxidized phosphatidylcholine) in cerebral spinal fluid (CSF) have been positively correlated with intensity of methotrexate (MTX) suggesting this may be a marker for acute central nervous system (CNS) toxicity. This study examined the association between phosphatidylcholine oxidation in CSF samples and executive functions one year post-consolidation treatment and at the end of chemotherapy.

**Participants and Methods:** Measures of oxidative stress and executive functioning were examined in 88 children newly diagnosed with ALL. The children were followed over three years and received annual parent ratings of executive functioning as well as other neurocognitive tests.

**Results:** Analyses showed an association between increased oxidative stress at induction and consolidation and poorer working memory and organization and attention problems two years later (all p's < .05). Younger age at diagnosis was associated with increased oxidative stress and increased executive dysfunction (p < .01).

**Conclusions:** These results suggest that biological markers of oxidative stress in the CNS may predict future functional problems. The results also underscore young age at treatment as a risk for CNS vulnerability to the effects of chemotherapy.

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H.M. CONKLIN, J. LAWFOR, B.W. JASPER, E.B. MORRIS, S.C. HOWARD, S.W. OGG, S. WU, X. XIONG & R.B. KHAN. **Side Effects of Methylphenidate in Survivors of Childhood Cancer: A Randomized, Double-Blind, Placebo-Controlled Trial.**

**Objective:** To investigate the frequency and severity of methylphenidate (MPH) side effects among childhood survivors of acute lymphoblastic leukemia (ALL) and brain tumors (BT), and identify predictors of higher side effect levels.

**Participants and Methods:** Childhood cancer survivors (N = 103; BT = 54, ALL = 49) completed a randomized, double-blind, three-week, home cross-over trial of placebo, low-dose MPH (LD; 0.3 mg/kg) and moderate-dose MPH (MD; 0.6 mg/kg). Caregivers completed the Barkley Side Effects Rating Scale (SERS) at baseline and each week during the medication trial. Siblings of cancer survivors (N = 49) served as a comparison group.

**Results:** There was a significantly higher number and severity of symptoms endorsed on the SERS when patients were taking MD compared to placebo or LD (p < .001) but not LD compared to placebo (p = .143 and p = .635, respectively). The number of side effects endorsed on the SERS was significantly lower during all three home-cross over weeks compared to baseline (p < .001). The severity of side effects was also significantly lower, compared to baseline screening, during placebo and LD weeks (p < .001 and p = .003, respectively), but not MD week (p = .925). The number and severity of symptoms endorsed at baseline were significantly higher for patients compared to siblings (p < .001 and p = .004, respectively). Among patients, female gender and lower IQ were associated with higher side effect levels (p < .05).

**Conclusions:** MPH is generally well tolerated by childhood cancer survivors. There is a subgroup at increased risk for side effects that may need to be closely monitored or prescribed a lower dose. The seemingly paradoxical findings of increased "side effects" at baseline must be considered when designing clinical trials.

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**H.M. CONKLIN, R.B. KHAN, W.E. REDDICK, J. ASHFORD, S.C. HOWARD, E.B. MORRIS, R. BROWN, M. BONNER, R. CHRISTENSEN, S. WU, X. XIONG & R.K. MULHERN. Long-Term Effectiveness of Methylphenidate in Enhancing Attention Regulation, Academic Abilities and Social Skills in Survivors of Childhood Cancer.**

**Objective:** There is evidence to support the short-term efficacy of methylphenidate (MPH) in addressing attention problems experienced by some cancer survivors. This study investigated the long-term effectiveness of maintenance doses of MPH. We hypothesized MPH would enhance attention regulation, academic abilities and social skills among survivors of childhood cancer.

**Participants and Methods:** Childhood cancer survivors (N=68; brain tumor= 35 and acute lymphoblastic leukemia= 33), identified as having attention deficits and learning problems, participated in a 12-month open-label MPH trial. Measures of attention [Conners' Rating Scales (CRS) and Conners' Continuous Performance Test (CPT)], academic abilities [Wechsler Individual Achievement Test (WIAT)] and social skills [Social Skills Rating System (SSRS)] were administered at pre-medication baseline and again at the end of a 12-month MPH trial while children remained on medication.

**Results:** Paired t-tests revealed a significant improvement in parent, teacher and self-report ratings of attention, hyperactivity and cognitive problems (CRS indices,  $p < .05$ ); participant performance on a measure of sustained attention (CPT- Omissions, Commissions, Reaction Time, Reaction Time Variability,  $D'$ ,  $\beta$  and CPT index,  $p < .01$ ) and parent ratings of social skills (SSRS;  $p < .01$ ). Improvement on attention measures resulted in normalization of clinically elevated test scores. While there was a significant improvement in raw scores on the academic measure (WIAT- Basic Reading, Reading Comprehension, Numerical Operations, Math Reasoning & Spelling,  $p < .0001$ ), these improvements did not correspond with an improvement in standard scores.

**Conclusions:** Attention and behavioral benefits of MPH for childhood cancer survivors are maintained in both the home and school setting over the course of a year long medication trial. While academic gains were not identified, MPH may offer protection from the previously well-established decline in academic abilities following cancer treatment.

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**B.L. FISCHER, W.T. HOYT & J.W. HALSTEN. Chemotherapy Contributes to Decline in Memory and Processing Speed.**

**Objective:** The literature on the cognitive effects of chemotherapy has yielded inconsistent results, in part because it has been plagued by methodological difficulties. Studies have contended with differences in participants' levels of cancer severity, chemotherapy agents and doses, number of chemotherapy sessions, ages and premorbid abilities. The current case study provides a unique opportunity to examine the role of chemotherapy and radiation on cognition while avoiding the influence of many frequently cited confounding variables.

**Participants and Methods:** A 39 year old woman was administered a comprehensive neuropsychological battery in 2002. Four years later she was diagnosed with breast cancer, and underwent surgery, chemotherapy, and radiation. She was referred for neuropsychological testing one year post-chemotherapy in 2007. Baseline tests were repeated in an attempt to assess evidence for the effects of chemotherapy and radiation on the patient's cognitive functioning. The patient denied knowledge of other contributions to declines in cognitive performance.

**Results:** The patient scored substantially worse on measures of processing speed, visuospatial functioning, verbal auditory memory and visual memory as assessed by the WAIS-III and WMS-III, with Cohen's  $d$  ranging from 1.0 to 1.8 on specific indices. Performance on tests of working memory, auditory and visual recognition remained stable compared to previous testing.

**Conclusions:** The results of this unusual case study are consistent with the hypothesis that chemotherapy and radiation exerted a substantially deleterious effect on the patient's level of cognitive performance in areas of memory, processing speed, and visuospatial functioning.

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**N. JAIN, P. BROUWERS, F. OKCU, P.T. CIRINO & K.R. KRULL. Sex-specific Executive Attention Problems in Long-term Pediatric Acute Lymphoblastic Leukemia (ALL) Survivors.**

**Objective:** Significant individual differences are apparent in neurocognitive outcomes of chemotherapy for pediatric leukemia. Although attention problems are a common occurrence, the specific pattern of deficits (i.e., inhibition, shifting, focusing, sustaining attention, and working memory) has not been well studied. Further, sex has been demonstrated to moderate the prevalence of neurocognitive problems in survivors. Therefore, the association between sex and the pattern of specific attention and related executive problems was evaluated in long-term survivors of pediatric ALL.

**Participants and Methods:** One hundred three long-term survivors ( $\geq 5$  years from diagnosis; 51% male, mean age at diagnosis of 46.7 months, and mean time since diagnosis 90.1 months) completed standardized neurocognitive measures targeting fronto-medial and dorso-lateral brain regions (i.e., inhibition, shifting attention, working memory), as well as posterior (i.e., focusing) and subcortical attention systems (i.e., sustaining).

**Results:** Girls performed worse than boys on anterior attention tasks (i.e., shifting attention,  $p < .05$ ) and subcortical attention tasks (i.e., sustaining attention,  $p < .01$ ), while boys performed worse than girls on different measures of anterior control (i.e., inhibition,  $p < .05$ ; working memory,  $p < .01$ ).

**Conclusions:** The results of this study suggest that pediatric survivors of ALL have difficulty with select measures of attention and executive control, and that performance is moderated by sex. Differential rates of grey and white matter development may account for the observed sex-based differences in performance, possibly due to treatment-related interruptions in cortical development and myelination. Future studies might discover other moderating factors to more optimally target individualized interventions.

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**N. JAIN, K.R. KRULL, L.L. ROBISON & M.M. HUDSON. Assessment of Neurocognitive Function in Very Long-Term Survivors of Pediatric Cancer.**

**Objective:** Most studies that evaluate neurocognitive outcomes following pediatric cancer focus on long-term survivors less than 10 years from diagnosis, while little is known about functioning after this time. In an effort to understand very long-term outcomes, a Lifetime Cohort study has been developed at St. Jude Children's Research Hospital that includes over 4,000 survivors who are at least 18 years of age and greater than 10 years from diagnosis. Feasibility of this study and preliminary results are reported.

**Participants and Methods:** The first 91 participants (54% male, mean age 35.9 years, 16-41 years post diagnosis) were evaluated with standardized neurocognitive measures. Diagnoses included leukemia, lymphoma, CNS tumor, osteosarcoma, or soft tissue sarcoma. All participants were treated with cranial radiation and/or chemotherapy often associated with neurocognitive problems.

**Results:** A relatively high prevalence of low scores (i.e.  $\geq 2$  SD below population mean) were observed on measures of intellect (18.7%), mathematics (14.8%), and memory skills (13.3%). High prevalence was observed on measures of attention (24.2%), motor dexterity (26.7%), and executive functions (29.7%). Few problems were noted on measures of reading (5.7%), memory span (5.6%), and long-term memory (7.7%). Overall, 59.3% of survivors demonstrated a score  $\geq 2$  SD below the population mean in at least one domain.

**Conclusions:** These preliminary results demonstrate the feasibility in assessing neurocognitive functions in very long-term survivors, and demonstrate relatively high rates of neurocognitive problems well into adulthood. Continued accrual of participants into this cohort will permit more rigorous analytic approaches designed to identify predictive sociodemographic and treatment related risk factors.

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#### A.D. KOHL, A. PAPAZOGLU, T.Z. KING, R. MORRIS & N. KRAWIECKI. Neurological Predictors of Academic Achievement in Adult Survivors of Childhood Brain Tumor.

**Objective:** Although academic achievement is low following diagnosis, little is known about achievement in adult survivors of childhood brain tumors. Research has shown an association between achievement and individual treatments and tumor-related medical conditions; however, the potential the cumulative and interactive effects is not well understood. We hypothesized that higher scores on the Neurological Predictor Scale (NPS; indicative of multiple treatment modalities and greater related medical conditions) would be associated with compromised academic functioning.

**Participants and Methods:** Participants were 25 survivors, who were an average of 18.66 years post-diagnosis (SD=4.04). Mean age at evaluation was 23.68 years (SD=4.47). The NPS was used as a predictor for performance on select subtests of the Woodcock-Johnson III Tests of Achievement: Letter-Word Identification, Calculation, Spelling, and Passage Comprehension.

**Results:** Mean academic achievement was in the low-average range for all subtests, except for Calculation, which was in the low range. The NPS was significantly predictive of performance on Letter-Word Identification ( $\beta=-.55$ ,  $p=.006$ ), Calculation ( $\beta=-.57$ ,  $p=.004$ ), and Spelling ( $\beta=-.61$ ,  $p=.001$ ), but not Passage Comprehension ( $\beta=-.36$ ,  $p=.089$ ). Our model was able to explain 30-38% of the variance across subtests. Furthermore, the NPS was a significant predictor of Spelling ( $\beta=-.41$ ,  $p=.049$ ), above and beyond radiation.

**Conclusions:** The findings of this study highlight the cumulative effects of brain tumor treatments and associated medical conditions on academic achievement, an average of 18 years following diagnosis. They also provide a means by which to identify patients at risk for future academic difficulties so that additional services may be applied. The role of learning disabilities will be discussed.

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#### L.K. LEJBAC, M. VRBANCIC & M. CROSSLEY. The Effect of Anti-Estrogen Medication Prescribed in the Treatment of Breast Cancer on Estrogen-Sensitive Neuropsychological Domains.

**Objective:** Neuropsychological domains that are presumed sensitive to estrogen levels include verbal and object-location memory, phonological fluency, selective attention, and speeded dexterity. Previous research has found that the anti-estrogen medications (e.g., tamoxifen, anastrozole) negatively impact immediate verbal memory and processing speed measures (Jenkins, Shilling, Fallowfield, Howell, & Hutton, 2004). The current study investigated the effect of anti-estrogen medication prescribed for breast cancer treatment on estrogen-sensitive domains.

**Participants and Methods:** Participants in the current study were 29 postmenopausal women taking anti-estrogen medication and 36 post-

menopausal healthy women; age and education were equivalent between the groups. A MANOVA was conducted with Group (Anti-estrogen vs. Healthy) as the independent variable and Immediate Verbal Memory, Delayed Verbal Memory, Object-Location Memory, Phonological Fluency, Working Memory, Selective Attention, and Speeded Manual Dexterity as the dependent variables.

**Results:** The overall MANOVA was significant,  $F(7, 57)=2.81$ ,  $p=.01$ , indicating that women taking anti-estrogen medication performed poorer overall on estrogen-sensitive measures compared to healthy women. Simple effects revealed that Phonological Fluency ( $p<.01$ ), Selective Attention ( $p<.01$ ), and Speeded Manual Dexterity ( $p<.01$ ) contributed to the overall effect. Unexpectedly, measures of memory did not differentiate the two groups.

**Conclusions:** This study supports previous research and demonstrates that anti-estrogen medication has a modifying effect on performance for some neuropsychological domains hypothesized to be estrogen-sensitive. Correspondence: Lisa K. Lejbak, PhD Student, Psychology, University of Saskatchewan, 3309 Cronkite St, Saskatoon, SK S7H 3X6, Canada. E-mail: lisa.lejbak@usask.ca

#### C.L. TRASK & A. MELTON. Academic Fluency Deficits in Children Treated for Brain Tumors.

**Objective:** Neurocognitive late effects (NCLE) have been associated with use of radiation, as well as chemotherapy, in survivors of pediatric cancer. Age at diagnosis, female gender, and disease recurrence have also been associated with NCLE. Some researchers have speculated that executive functions, such as processing speed and working memory, play a fundamental role in the more global deficits observed in analytic skills and academic performance; however, the effects on academic fluency have not been established.

**Participants and Methods:** A retrospective case review study was conducted on neuropsychological test data from 21 patients (11 males, 10 females) treated for a brain tumor. The mean age at diagnosis was 7.9 years (SD = 3.6), and the mean age at testing was 14.6 years (SD = 4.3).

**Results:** The degree of relative weakness in academic fluency was examined in relation to previously identified risk factors and other demographic variables. After controlling for general academic skills, slower processing speed and female gender were related to relative weaknesses in math fluency and reading fluency. Other treatment and disease-related risk factors were not related. A significant weakness in processing speed was observed in 47.6% of the sample relative to verbal reasoning abilities and 38.1% relative to visual analytic skills.

**Conclusions:** This study illustrates that not only is general processing speed impacted by treatments for brain tumors, but this cognitive slowing also translates into real deficits in academic fluency that can affect children in a classroom environment. Implications for treatment and/or cognitive rehabilitation are offered.

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#### M.A. MUMAW, T.Z. KING, H. MAO, R. MORRIS & N. KRAWIECKI. Prefrontal White Matter Integrity and N-back Performance in Adult Survivors of Childhood Brain Tumors.

**Objective:** Adult survivors of childhood brain tumors, especially those treated with radiation, are at risk for disruption in white matter pathways and impaired working memory. N-back performance may be negatively related to white matter integrity assessed via diffusion tensor imaging (DTI) in a group of adults who were treated for childhood brain tumors

**Participants and Methods:** Nine survivors of childhood brain tumors (years since diagnosis Mean=17.0, SD=2.33), five of whom received radiation, and eight healthy individuals completed the n-back task. Survivors were similar in age to controls (Mean=24.1 years, SD=3.91). DTI was conducted on 3T Phillips (16 directions). Fractional anisotropy (FA) values were obtained outlining ROIs with Pride Fibertracking V4 software.

**Results:** Survivors who received radiation performed significantly worse on each n-back working memory condition relative to survivors not treated with radiation (1 through 3 back,  $p < 0.05$ ) as well as controls ( $p < 0.05$ ). In contrast, groups were not significantly different in detecting a target (0-back). The radiation group demonstrated significantly lower FA values within the right, anterior prefrontal cortex when compared to the non-radiation group ( $t = 2.97$ ,  $p < 0.05$ ) and controls ( $t = 2.42$ ,  $p < 0.05$ ). FA values in this region were significantly and positively correlated with performance on the n-back tasks (total n-back:  $r = .655$ ,  $p = .004$ ). SB4 sentence repetition was not correlated with FA ( $r = .447$ ,  $p = .228$ ).

**Conclusions:** The findings support a link between damage to frontal lobe white matter and reduced working memory skills in adult survivors of pediatric brain tumors treated with radiation.

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#### A. MYERS. Cognitive Disabilities Among Leukemia Survivors.

**Objective:** Children receiving treatment for acute lymphoblastic leukemia (ALL) may experience intellectual deficits, and it has become clear that the possibility of cognitive dysfunction among survivors of childhood ALL needs to be investigated. Their problems with focusing attention inhibited the development of automaticity in calculating basic sums, delaying progress in arithmetic skills. Similarly, deficits in the ability to engage in on line planned, strategic, or metacognitive behavior, which result from focusing problems, will lead to poor performance in more complex mathematical tasks. Spelling difficulties might be attributable to memory impairments.

**Participants and Methods:** Cognitive ability in 9 survivors of acute lymphoblastic leukemia and 9 sibling controls was assessed using a neuropsychological model of attention and the effect on their cognitive abilities. Arithmetic and digit span subtests to examine the focus encode elements of attention. All of these tests are commonly used to assess orienting and attentional skills and freedom from distractibility and are believed by Mirsky and colleagues to be appropriate methods of assessing this aspect of performance.

**Results:** Results indicated that children who have received treatment for leukemia have difficulty in focusing attention, and it was suggested that many of the focusing difficulties experienced by the ALL group are exacerbated by a decreased speed of information processing. In the end, problems with focusing attention inhibited the development of automaticity in calculating basic sums, delaying progress in arithmetic skills.

**Conclusions:** The potential importance of the results is that a detailed and comprehensive examination of attentional ability among children treated for ALL may yield information that can be used to develop tools of remediation to target their specific needs. The study indicates that difficulties at school may result from an inability to focus attention. Correspondence: *Amy Myers, PhD, Baylor University, 3220 Stonewall Road, Hampton Cove, AL 35763. E-mail: amy\_myers@baylor.edu*

#### A. MYERS. Academic Achievements of Children with Brain Tumors.

**Objective:** Cancer treatment may affect school performance. Scholastic achievements after childhood brain tumors have not been previously reported on the level of actual grades.

**Participants and Methods:** Patients with brain tumor ( $n = 30$ ) were identified from a convenient sample. Their ninth grade school reports were obtained from Statistics Finland. Age at diagnosis and cranial irradiation (CRT) were considered in analyses, and the level of parental education was taken into model as a covariate.

**Results:** Six percent of patients did not finish their comprehensive school at the usual age. Patients had lower overall averages than their controls (95% CI for the difference  $-0.30$ ,  $-0.16$ ). Girls differed from their controls independently of the age at diagnosis or CRT. Boys treated with CRT at school age, but not before school age, had poorer results than

their controls (95% CI  $-0.65$ ,  $-0.13$ ). The grades of patients were significantly lower in each school subject, and differed most in foreign language. Young girls with CRT had greatest differences from their controls (95% CI  $-1.73$ ,  $-0.86$ ) in this subject. In mathematics, patients diagnosed before school age had greatest difference from their controls. In their mother tongue, patients differed less from their controls.

**Conclusions:** Few patients with brain tumor missed the ninth grade certificate at the age of 16. Grades in foreign language (representing verbal performance) were most affected. However, the patients fared poorer than controls in each subject. The difference was most pronounced among girls. Girls were more sensitive to the adverse effects of irradiation.

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#### R. NAIDOO & G.J. REY. Assessing Neurocognitive Functioning of Pediatric Neuro-Oncology Patients: The Challenges.

**Objective:** The neurocognitive morbidity of radiation and chemotherapy is well documented. However, there is little consensus in the selection of assessment measures that are sensitive to capturing subtle changes. Psychometric characteristics of assessment tools and the developmentally diverse pediatric population present challenges for practitioners. In this study, the neuropsychological assessment data (NAD), age at diagnosis, duration of treatment, and inherent differences in acute lymphoblastic leukemia (ALL) and brain tumors (BT) treated with radiotherapy, chemotherapy, and/or brain resection were compared.

**Participants and Methods:** NAD of 20 pediatric patients (36 to 146 months of age; ALL:  $N = 8$ ; BT  $N = 12$ ) either pre-treatment (N=8) or post (N=12) COG treatment protocols were collected. NAD of children who received radiotherapy and/or chemotherapy were compared using ANOVA.

**Results:** Combined radiotherapy/chemotherapy patients had lower neurocognitive functioning (NCF) across all domains compared to chemotherapy-only patients, with the greatest differences for language skills (narrative memory  $F = 6.38$ ,  $p < 0.01$ ; receptive vocabulary  $F = 5.83$ ,  $p < 0.03$ ). Children with ALL had higher FSIQ ( $F = 4.497$ ,  $p = 0.05$ ), visual-motor integration ( $F = 4.52$ ,  $p = 0.05$ ), calculation ( $F = 12.13$ ,  $p < 0.01$ ), and verbal memory ( $F = 3.66$ ,  $p = 0.01$ ) scores compared to the BT sample. Within group differences for duration, treatment, age at diagnosis and time since completion of treatment were not significant.

**Conclusion:** Consistent with prior studies, BT by the nature of the disease and its treatments have worse cognitive outcomes than ALL. Within these groups, neurodevelopment stage, susceptibility to the toxic effects of treatment, neural plasticity, and environmental enrichment affect the overall response to treatment, and the manifestation of the late effects of oncological therapies.

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#### K.A. O'BRIEN, M.D. SWARTWOUT, P.T. CIRINO & C.A. MEYERS. Surgical Morbidity in Patients with Low Grade Glioma.

**Objective:** Surgical resection is controversial in the management of low grade gliomas (LGG). Accurate assessment of cognitive dysfunction is important for patients with LGG as they may live without disease progression for years after initial diagnosis and treatment. Controlled Oral Word Association Test (COWA), a measure of verbal fluency, is associated with left frontal lobe function, and may be sensitive to LGG tumors in this area.

**Participants and Methods:** 117 patients with confirmed supratentorial LGG underwent a comprehensive neuropsychological assessment before and after surgical resection. Patients were divided into 2 groups based on location of tumor (Left Frontal vs. Other), and according to years of education (high school vs. college). A 2x2x2 repeated measure ANOVA (time x location x education) was performed with COWA raw scores.

**Results:** There were main effects for time, location, and education. Location interacted with time, such that the left frontal group showed greater decline in performance on COWA post-surgery. A significant three-way interaction indicated that education moderated this effect. Patients with greater than high school education and left frontal LGG were more adversely affected by surgery than the other subgroups.

**Conclusions:** Patients with left frontal tumors have poorer verbal fluency than those with tumors in other locations, as expected. Higher cognitive reserve, measured by years of education, does not appear to be a protective factor against this decline as subjects with left frontal tumors had similar verbal fluency performances, regardless of education. This is not the case with patients harboring tumors in other locations, where performances remained stable.

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**R. PEREZ, G. ALLEN, L. GARGAN, K. HAGAR, L.S. HYNAN & P.L. STAVINOHA. Behavioral Sequelae of Childhood Surgical Resection of Cerebellar Pilocytic Astrocytomas.**

**Objective:** Children surgically treated for cerebellar tumors are at risk for a variety of psychological problems, but due to differences in assessment methods (interview, observation, ratings) and scope of investigation, it is difficult to gain a clear understanding of the emotional and behavioral difficulties they encounter. The current study utilized parent and teacher forms from the Behavior Assessment System for Children-2nd Edition (BASC-2) to examine emotional and behavioral functioning in the home and school settings in children with a history of surgically resected cerebellar pilocytic astrocytomas (CPA).

**Participants and Methods:** Twenty children who underwent only surgery for CPA (no chemotherapy or radiation) and were between the ages of eight and 16 years were recruited, and a total of 20 parent and 14 teacher BASC-2 questionnaires were obtained for the study.

**Results:** Parent ratings indicated that children with CPA displayed significantly more problems than the standardization sample on measures of depression, withdrawal, and overall behavioral difficulties, as well as in several areas of adaptive functioning, including social skills, activities of daily living, functional communication, and overall adaptive skills. While parent ratings revealed significantly more problems than the standardization sample in these areas, the mean parent ratings still fell within the normal range. No significant differences were found on the teacher ratings.

**Conclusions:** The results suggest a profile of mild emotional, behavioral, and adaptive skills difficulties. Children treated for CPA demonstrate more difficulties than peers with depressed mood, social withdrawal, behavioral regulation, and adaptive functioning.

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**S.S. STENZEL, I.M. MOORE, N. JAIN, M.J. HOCKENBERRY, K.L. KAEMINGK & K.R. KRULL. Oxidative Stress and Neurobehavioral Problems in Pediatric ALL Patients Undergoing Chemotherapy.**

**Objective:** Neurobehavioral problems following intravenous (IV) and intrathecal (IT) methotrexate (MTX) treatment for pediatric acute lymphoblastic leukemia (ALL) have been a recent focus of investigation. Although most children experience good behavioral outcomes, a significant subset appears to be negatively affected. Reliable early identification of patients "at risk" for poor neurobehavioral outcome is not yet possible. This study extended previous research that suggested oxidative stress as a potential mechanism for MTX-induced central nervous system (CNS) injury by examining early markers of CNS oxidative stress in relation to subsequent behavioral problems.

**Participants and Methods:** Oxidized and unoxidized components of phosphatidylcholine (PC), the most abundant phospholipid present in CNS cell membranes, were measured in the cerebrospinal fluid (CSF) of 87 children with ALL at diagnosis, induction, and consolidation. Behavioral outcomes were evaluated post-consolidation, at the end of therapy, and one year after completion of therapy.

**Results:** Significant agreement was demonstrated between physiological reactivity (high versus low PC changes from diagnosis) and behav-

ioral outcomes (high versus low pathology). Unoxidized PC change was related to atypicality and the development of social skills after the completion of therapy. Oxidized PC fraction changes were predictive of poor behavioral outcomes following consolidation and at the end of therapy. Elevated oxidized PC was related to increased problems with attention, aggression, and conduct. Furthermore, symptoms of hyperactivity over time were related to unoxidized PC and oxidized PC fraction.

**Conclusions:** These findings suggest that increases in CSF PC markers of oxidative stress during induction and consolidation may help predict certain future behavioral problems.

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**L.M. VAUX, M. LYON, K. WELDON, K. WRIGHT, D. TRANEL, S.W. ANDERSON, D.J. BERG, S. SCHULTZ, R.B. WALLACE, E. CHRISCHILLES, C.F. LYNCH & N.L. DENBURG. Patterns of Neuropsychological Functioning Among Cancer Survivors.**

**Objective:** There are a growing number of studies investigating the effects of cancer and chemotherapy on cognition. However, most are based on small volunteer samples, which may restrict their external validity and generalizability. In the present study, we obtained data for cancer survivors referred for clinical neuropsychological evaluation and examined the performance of a large subset.

**Participants and Methods:** A computerized linkage was conducted between the state-wide Iowa Cancer Registry and the Benton Neuropsychology Laboratory database, excluding patients with developmental disorders, focal neurological conditions, and CNS tumors. This linkage yielded 355 adults, with a history of cancer, aged 45 and older. Through a chart review, individual test scores were extracted. We focused on primary domains of cognitive functioning, and on tests that were administered with the greatest frequency in order to keep the sample size high.

**Results:** Relative to normative data, cancer survivors performed in the severely impaired range on Boston Naming and Grooved Pegboard tests ( $z_s = -4.8$  to  $-7.1$ ); in the moderately impaired range on Controlled Oral Word Association, Benton Facial Discrimination, Trailmaking, and Benton Visual Retention tests ( $z_s = -1.0$  to  $-2.5$ ); and in the mildly impaired range on WAIS Arithmetic, Digit Span, Block Design, and Coding subtests ( $z_s = -.5$  to  $-.9$ ). By contrast, cancer survivors performed normally on the Rey-Auditory Verbal Learning Test ( $z_s = +.5$  and above).

**Conclusions:** These findings indicate that, among a large sample of cancer survivors, cognitive abilities such as attention, processing speed, and problem-solving appear to be most affected, whereas basic anterograde memory remains largely intact. Although the frontal lobes appear most affected in these survivors, another possibility is involvement of widespread cortical regions (possibly via underlying white matter dysfunction).

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**K.J. VEARNCOMBE, M. ROLFE, N.A. PACHANA, M.J. WRIGHT & G. BEADLE. Specific Cognitive Decline: Domains and Associated Contributing Factors for Cognitive Dysfunction after Chemotherapy.**

**Objective:** While there is evidence that cognitive dysfunction occurs after the administration of chemotherapy, debate continues as to whether cognitive changes are the result of cytotoxic treatment or other treatment-related effects.

**Participants and Methods:** The neuropsychological performance of 141 breast cancer patients scheduled to receive chemotherapy was assessed pre-chemotherapy and one month post chemotherapy. Demographic, quality of life (QOL), mood, blood biochemistry and treatment-related information was also collected at both time points. A control group of eight breast cancer patients not receiving systemic therapy was recruited in order to control for practice effects.

**Results:** Reliable decline on at least two measures was seen in 15.5% of women post chemotherapy. The cognitive domains predominately affected were verbal learning and memory, abstract reasoning, and working memory. To account for multiple comparisons a  $p$  value  $\leq .01$  was utilised for subsequent analyses. Partial correlations controlling for age, education and intelligence found that cognitive change was associated with numerous factors including baseline fatigue, QOL, social well-being, estrogen receptor status, depression, functional wellbeing and change in social wellbeing. However, logistic regressions found cognitive impairment was only predicted by lower baseline physical well-being ( $p = .009$ ), although trends were seen in baseline social well-being ( $p = .03$ ), fatigue ( $p = .039$ ), haemoglobin ( $p = .019$ ) and haematocrit levels ( $p = .027$ ). No variables predicted overall cognitive impairment when the domains were combined.

**Conclusions:** The results indicate that multiple factors may play an important role in the extent of cognitive dysfunction experienced by survivors and requires further investigation.

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**K.S. WALSH, E.M. WELLS, Z.P. KHADEMIAN, R. SPOSTO, G. VEZINA, R.F. KEATING & R.J. PACKER. Neuroradiographic Features of Patients with the Cerebellar Mutism Syndrome: A Longitudinal MRI Study.**

**Objective:** The etiology and long-term outcome of the cerebellar mutism syndrome (CMS), a postoperative syndrome of diminished speech, hypotonia, and ataxia, which affects 25% of patients, is poorly elucidated. The current study was undertaken to determine 1) factors associated with development of CMS 2) means to determine its severity or etiology and 3) outcomes of these patients.

**Participants and Methods:** The pre-, immediate post-, and one year post-operative MRI, clinical features, neurologic and neurocognitive outcomes of 28 consecutive children with medulloblastoma (39%), 11 of which had CMS, either operated on or referred soon after surgery to our institution, were reviewed. The neuroradiographic review was blinded.

**Results:** The preoperative scans showed no differences in tumor size, hydrocephalus or peritumoral edema. There were trends toward a correlation with tumor location at the brainstem ( $p=0.05$ ) and the cerebellomedullary angle ( $p=0.08$ ). Immediate post-operative scans showed cerebellar edema in 92% of all patients; CMS patients had more superior cerebellar peduncle edema ( $p<0.05$ ) and a trend toward more middle cerebellar peduncle edema ( $p=0.07$ ). At one-year, patients with CMS had more moderate to severe atrophy/gliosis of total cerebellum ( $p<0.01$ ), vermis ( $p<0.01$ ), and brainstem ( $p<0.05$ ). Mean IQ was eleven points lower in patients with CMS (IQ=78.5, SD 19.8) compared to those without (IQ=89.5, SD 26.5). Additional neurocognitive outcomes will be discussed.

**Conclusions:** CMS is associated with lasting post-operative damage to the cerebellum and brainstem; damage not identified on immediate post-operative MRI. Our incidence of CMS has diminished following change in surgical technique, but long-term outcome for those affected is poor. Correspondence: *Karin S. Walsh, PsyD, Division of Pediatric Neuropsychology, Children's National Medical Center, 111 Michigan Avenue NW, Suite 1200, Washington, DC 20010-2970. E-mail: kwalsh@cnmc.org*

**T. YAMADA, C.M. NGUYEN, L.M. VAUX, L. BEGLINGER, N.L. DENBURG & S.K. SCHULTZ. Cognitive and Psychosocial Well-Being in Breast Cancer Survivors.**

**Objective:** Recent research has focused on cognitive deficits as a result of chemotherapy with breast cancer patients both throughout treatment and shortly after treatment. However, little to no research has explored the neurocognitive and psychosocial sequelae in long-term survivors. This study aims to explore the cognitive functioning and psychosocial well-being of breast cancer survivors.

**Participants and Methods:** Participants were recruited through the Iowa Cancer Registry and had to be female, at least 65 years old, and 10 years post-breast cancer diagnosis and treatment ( $N = 45$ ; Mage = 72.2 years; Meducation = 14.6 years). Each participant was given a three-hour neuropsychological battery to evaluate a variety of cognitive domains. Additionally, psychosocial well-being was assessed through a self-report questionnaire in the domains of social, emotional, physical, and functional well-being.

**Results:** Participants' performance on cognitive tasks was compared to a sample of age- and education-matched community-dwelling older adults, and z-scores were computed for the breast cancer survivors. Performances on Trailmaking A & B and the Mini Mental Status Exam were moderately impaired (z-score  $> -1.0$ ), and performances on the WAIS Working Memory Index and Trial 1 of Rey-Auditory Verbal Learning task were mildly impaired (z-score =  $-0.5$  to  $-0.9$ ). In contrast, breast cancer survivor participants reported better functional well-being in all domains (z-score =  $.5$  to  $.9$ ) on the FACT-G, compared to published normative data.

**Conclusions:** In a unique sample of breast cancer survivors at least 10 years post-diagnosis and -treatment, we found an interesting dissociation between cognitive performance and psychosocial functioning. Specifically, though breast cancer survivors had relatively weaker cognitive performances, particularly in the domain of executive functioning, they self-reported greater psychosocial well-being socially, emotionally, physically, and functionally.

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## Epilepsy/Seizures

**K.T. BAUM, C. CHIU & A.W. BYARS. Associative Memory Strategies in Children with New-Onset Seizures.**

**Objective:** Previous research on the memory abilities of children with seizures have produced mixed results. Some studies reported memory difficulties whereas others did not. This discrepancy may be due to several factors, including the method of assessment, variability in the types of seizures or syndromes, variability in the use of antiepileptic medications, and so on. Memory paradigms that are sensitive to the function of the medial temporal lobe, such as paired associative memory tasks, have been relatively less studied. No studies have examined associative memory strategies in children with new-onset seizures. Additionally, it is not known whether these patients benefit from memory strategies that have proven beneficial in improving memory performance in typically-developing children.

**Participants and Methods:** As part of a larger three-year longitudinal study, 16 children were evaluated 36 months after their first recognized seizure. Seven siblings of these children were recruited as control subjects. In addition, ten typically-developing children with similar age profiles and similar performance on this study's associative memory measure were used as controls. A paired associate learning task was administered to all participants. All children were instructed in the use of two learning strategies: simple covert repetition of the word pairs and imaging the referents interacting with one another.

**Results:** Independent t tests showed that the recall advantage of the imagery strategy, as well as total recall, was not significantly different between children with seizures and controls.

**Conclusions:** The memory performance of children with seizures reveals that they benefit equally from the use of mnemonic strategies as do typically-developing children.

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**E.L. BEGYN, O.J. BENITEZ, C.L. CASTILLO, P.L. STAVINOHA & K.S. HAGAR. Differences in Parent-Reported Executive Functioning in Pediatric Seizure Disorders.**

**Objective:** Epilepsy is the most common neurological condition in children, affecting 150,250 to 325,000 children between the ages of 5 and 14 in the United States. Psychological research has consistently found that children with epilepsy are at increased risk for neurocognitive impairment, including executive functioning deficits. However, minimal research has addressed executive functioning among different types of seizure manifestations. This study aimed to identify the relationship between seizure type (generalized seizures, partial seizures, or partial seizures with secondary generalization) and parent rating of executive functioning in children with epilepsy.

**Participants and Methods:** The Behavior Rating Inventory of Executive Function (BRIEF, Parent Form) was administered to 40 parents of children with one of three types of seizures as part of an outpatient neuropsychological evaluation. Patients included 21 males, 23 of whom were Caucasian, ages 4 to 17. Retrospective chart review was utilized to obtain BRIEF scores. A one-way ANOVA was conducted in order to evaluate whether the level of executive dysfunction varied among the seizure types.

**Results:** Results indicated that children with generalized seizures ( $M = 74.88$ ,  $SD = 17.96$ ) exhibited more metacognitive deficits than children with partial seizures ( $M = 59.47$ ,  $SD = 13.90$ ),  $F(2, 37) = 3.60$ ,  $p = 0.04$ .

**Conclusions:** It can be concluded that the different clinical manifestations of seizures may produce unique patterns in executive functioning within pediatric populations, such as found in this study.

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**A. BRAATEN & A.Y. STRINGER. The Effects of Handedness and Side of Seizure Focus on Neuropsychological Test Performance in Patients with Temporal Lobe Epilepsy.**

**Objective:** Although handedness is known to affect language lateralization, research is limited regarding handedness as a moderator in temporal lobe epilepsy (TLE). Handedness in TLE may be important given possible material-specific memory decline following surgery. This study characterizes neuropsychological and Wada Test performance of left-handed TLE patients and contrasts them with a matched right-handed TLE sample.

**Participants and Methods:** Twenty-three left-handed TLE patients (12 males, mean age=33, mean epilepsy onset=253 months). Twelve patients had right and 11 had left-hemisphere seizure onset. All underwent neuropsychological examination and 12 underwent the Wada test. For comparison, patients were matched by age, sex, months since onset, and side of seizure focus with a group of right-handed TLE patients.

**Results:** Twenty-one left-handers had left-hemisphere language dominance, while 2 displayed reversed dominance. Left-handers with right-sided seizures demonstrated greater impairment in visuospatial memory ( $p < .05$ ), while patients with left-sided seizures had impaired verbal memory ( $p < .05$ ). Wada results were consistent with this, with participants performing more poorly on language and verbal memory during left-hemisphere injection. Left and right-handed patients had similar cognitive profiles, with the exception of left-handers showing poorer problem solving. Regardless of dominance, left TLE patients performed worse than right TLE patients on the California Verbal Learning Test 5th learning trial ( $p = .015$ ), short ( $p = .02$ ) and long-delay recall ( $p = .001$ ), and Reitan Story Memory ( $p = .041$ ).

**Conclusions:** Left-handers demonstrated primarily left-hemisphere language dominance, and performed similarly to right-handers on most measures of neuropsychological functioning. The Wada test was equally useful in left and right-handers in identifying language and memory lateralization.

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**A.M. PIZZI, J.S. CHAPIN, G.E. TESAR & R.M. BUSCH. Patients with Frontal and Temporal Lobe Epilepsies Report Similar Emotional and Personality Traits.**

**Objective:** The current study sought to characterize and compare personality traits of patients with the two most common focal epilepsies, temporal lobe epilepsy (TLE) and frontal lobe epilepsy (FLE). We first sought to determine which personality factors, if any, differed in patients with epilepsy as compared to normal controls. We then investigated whether personality factors differed between patients with FLE and TLE.

**Participants and Methods:** Ninety-seven adults with medically intractable epilepsy (TLE = 58; FLE = 5) completed the Personality Assessment Inventory (PAI) as part of routine preoperative investigations. PAI scores were used to compare mood and personality characteristics of FLE patients, TLE patients, and normal controls. T-tests were used to compare PAI scores of epilepsy patients to the normal controls, and MANOVA was used to compare PAI scores between patients with FLE and TLE.

**Results:** Not surprisingly, results revealed that both epilepsy groups endorsed significantly more symptoms across most PAI clinical scales than the normative sample. Unexpectedly, symptom endorsements on the PAI were quite similar among TLE and FLE patients. The only difference between the two epilepsy groups was a trend toward greater item endorsement on the Borderline Features scale among FLE patients as compared to TLE patients.

**Conclusions:** Our results suggest that mood and personality traits often observed in patients with intractable epilepsy may be more related to the presence of epilepsy than the location of seizure focus.

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**F. CONSTANTINIDOU, D. THEMISTOCLEOUS, M. NICOU & S. PAPANICOLAOU. The Effects of Chronic Epilepsy on Working Memory Performance and Executive Abilities.**

**Objective:** The primary objective was to investigate verbal learning, working memory, and executive functioning abilities in adults with epilepsy. This study is part of the first systematic research program exploring neuropsychological performance and quality of life issues in Greek-Cypriots with epilepsy.

**Participants and Methods:** Thirty Greek-Cypriot adults with chronic epilepsy (ages 18-55) were matched to 25 neurologically normal adults on age, gender, and education levels. All participants with epilepsy were recruited from the Cyprus Institute of Neurology and Genetics. A battery of neuropsychological tests and 2 quality of life assessments were implemented. Participants were screened for global cognitive decline and clinical depression.

**Results:** Mixed model MANOVA ( $\alpha = .05$ ) results indicated that the performance of participants with epilepsy was significantly lower than that of normal cohorts on repeated verbal learning tasks (RAVLT). Pairwise ( $\alpha = .05$ ) comparisons demonstrated that performance was lower on both verbal and non-verbal working memory measures,  $\alpha = .05$  (digit span forward/backwards, visual span forward/backwards, Rey Complex Figure Test, and paragraph recall immediate/delayed). In addition, performance was significantly lower ( $\alpha = .05$ ) on executive functioning and mental fluency tasks (COWAT, Symbol Digits Modalities Test, Trails A & B). Performance on executive tests correlated significantly ( $\alpha = .05$ ) with memory performance.

**Conclusions:** Results indicate that chronic epilepsy hampers verbal learning and memory performance despite of the focus of the epileptic activity. Furthermore, the reduction in executive functioning which interferes with the use of active memory strategies probably contributes to the memory impairment observed in the present study. Future studies should explore the use of active memory strategies in adults with epilepsy to facilitate working memory performance.



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**L. FELIX & S.J. HUNTER. The Relative Contribution of Executive Functioning to the Relationship between Cognitive and Academic Functioning in Children with Epilepsy.**

**Objective:** Pediatric patients with epilepsy are at risk for academic underachievement. Cognitive ability is the single largest predictor of academic achievement. Executive functioning contributes to academic achievement in pediatric patients with epilepsy, based on parent-report. Performance-based executive function instruments distinguish among regulatory processing activities, but are limited in ecological validity. Consequently, using information provided by parents is essential. This study examines the contribution of performance-based and parent-rated executive functioning, above intelligence, to academic achievement.

**Participants and Methods:** Sample included pediatric patients with epilepsy referred for assessment. Measures included the Woodcock-Johnson Tests of Achievement – Third Edition; Wechsler Intelligence Scale for Children, Fourth Edition; Tower subtest from the NEPSY or D-KEFS, based on age; and the Behavior Rating Inventory of Executive Function. Multiple regression analyses were conducted with reading and mathematics achievement as dependent variables. Independent variables were overall cognitive abilities, performance-based executive functioning, and parent-rated executive functioning.

**Results:** Results indicated neither performance-based nor parent-rated executive functioning measures contributed significantly, above overall cognitive ability, to performance on reading and mathematics achievement tests. Performance-based executive functioning was not significantly correlated with reading achievement, but was significantly correlated with mathematics achievement. Parent-rated executive functioning was not significantly correlated with either reading or mathematics achievement.

**Conclusions:** Executive functioning may play a role in classroom performance and parent-rated achievement, but current results indicate that it does not contribute independently to academic achievement.

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**N.M. GRIFFITH, B.K. SCHEFFT, J.P. SZAFARSKI, S.R. HOWE & M.D. PRIVITERA. Exploring the Relationships Between Explanatory Style and Depressive Symptoms Among Patients with Intractable Seizure Disorders: Optimism and Pessimism as Predictors of Seizure Group.**

**Objective:** Psychosocial risk factors of psychological disorders in epilepsy have received much less attention than biological factors. It is well-established that pessimistic explanatory style is strongly associated with depression and other adverse health outcomes in chronic illness. However, optimism and pessimism have rarely been studied in seizure disorder populations. The objective of this study was to determine whether optimism and pessimism provide incremental predictive utility over and above other predictors of seizure group (temporal lobe epilepsy, psychogenic nonepileptic seizures).

**Participants and Methods:** Diagnosis for all participants was confirmed by prolonged video/EEG monitoring. The Revised Optimism-Pessimism Scale (PSM-R), a content-based MMPI scale, was used to compute optimism and pessimism scores for all participants. Correlations of optimism, pessimism, and MMPI clinical scale scores were computed. Logistic regression was used to generate a model for predicting seizure group.

**Results:** Pessimism was strongly positively associated and optimism was strongly negatively associated with severity of depressive symptoms across all seizure groups. For optimism, effects of seizure group (ES more than PNES) and sex (male more than female) were found. Both optimism and pessimism provided significant incremental predictive utility over and above other predictors of seizure group.

**Conclusions:** Results indicated that explanatory style is a relevant index of personality and cognitive response to stress among an intractable seizure disorder sample. Results also supported the validity of the PSM-R as a measure of explanatory style in this sample. Advantages of using the proposed prediction model over other alternative differential diagnostic procedures include lower cost, greater availability, and increased standardization.

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**N. HANTKE, A. THOMPSON, V. PHATAK & N. CHAYTOR. The Personality Assessment Inventory as a Tool for Diagnosing Psychogenic Non-epileptic Seizures.**

**Objective:** We investigated the Personality Assessment Inventory (PAI) as a diagnostic tool for psychogenic non-epileptic seizures (PNES). The objective of the present study was to compare the diagnostic performance of the PAI conversion subscale (SOM-C) alone vs. Wagner's PNES Indicator (Wagner et al, 2005).

**Participants and Methods:** Subjects with an electrographically confirmed diagnosis of PNES (N=75) or epileptic seizures (ES) (N=109), and a valid PAI profile were included.

**Results:** Compared to patients with ES, patients with PNES had significantly higher mean scores on the PAI somatic complaints scale as well as somatization and SOM-C subscales. Both groups had elevated (but not significantly different) scores on the health concerns subscale. Wagner's PNES Indicator was 58.7% sensitive and 85.3% specific at diagnosing PNES. The SOM-C scale was 58.7% sensitive and 83.5% specific at diagnosing PNES. Assuming a PNES prevalence of 30% in a typical epilepsy monitoring unit, the SOM-C scale has a positive predictive value and negative predictive value of 60.4% and 82.5%, respectively.

**Conclusions:** Wagner's PNES Indicator is a construct based on the idea that patients with PNES have conversion symptoms that outweigh health concern symptoms compared to patients with ES. That idea is not supported by this analysis and Wagner's PNES Indicator does not appear to be more useful than the SOM-C subscale alone at diagnosing PNES. Overall, the PAI offers advantages over other personality measures, making it clinically useful as an adjunctive diagnostic tool for differentiating PNES from ES.

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**T. FARMER & S.J. HUNTER. Neuropsychological moderators of social skills in children with complex partial and primary generalized epilepsy.**

**Objective:** Epilepsy can lead to behavioral and neuropsychological sequelae depending on the type of seizure. Neuropsychological profiles associated with primary generalized seizures (PGE) and complex partial seizures (CPS) were examined with regard to their moderating impact on social skills. We hypothesized that children with PGE would have deficits in executive functioning and speed of information processing, while children with CPS would present with deficits in language, memory, perceptual abilities, and nonverbal fluency. These deficits would impact stages of social information processing in a distinguishable manner, disrupting the ability to integrate social information and develop appropriate social skills.

**Participants and Methods:** The study used archival data collected by the University of Chicago Pediatric Neuropsychology Service, and included 47 patients ranging between 8 and 16 years of age. All participants underwent a neuropsychological battery assessing various cognitive domains. Additionally, measures of social skill were derived from parent questionnaires (BASC). ANOVA and multiple regression analyses were conducted to examine the contribution seizure type and neuropsychological profile have on social skill development.

**Results:** Results highlighted that children with CPS had significant deficits on tasks of verbal ability, impacting general intelligence and memory, while deficits in working memory and processing speed were found for children with PGE. No clear relationship emerged between these deficits and patterns of social skill development, although modest trends were noted in regard to social deficits in children with CPS.

**Conclusions:** Although differences in functioning between the two seizure disorder types were identified, consistent with current literature, only a modest relationship with social skill functioning was found, and for the CPS group only. Further approaches to research concerning this relationship are suggested.

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**B.L. JOHNSON-MARKVE, G.P. LEE, A.M. MURRO, Y.D. PARK & J.R. SMITH. Prognostic Utility of a Prediction Model for Memory Decline Following Epilepsy Surgery.**

**Objective:** Memory decline following epilepsy surgery is dependent upon multiple cognitive and seizure-related factors. Several mathematical risk models have been developed to predict postoperative memory decline, but virtually no research has evaluated their prognostic efficacy. This study assessed the predictive value of the multivariate risk factor model of Stroup (2003) on postoperative memory outcome.

**Participants and Methods:** 90 (41 right and 49 left) temporal and frontal epilepsy surgery patients underwent neuropsychological evaluation pre- and post-surgery. Patients were assigned into one of four risk groups (i.e., none, mild, moderate, or severe risk) for postoperative memory decline using Stroup's criteria. Patients at greatest risk had dominant hemisphere resections, absent hippocampal sclerosis, normal Wada memory, and high preoperative memory test scores. Memory decline was determined using pre- minus post-surgery memory test differences scores, and memory outcome was then compared across groups.

**Results:** There were significant left- versus right-sided surgery group differences as well as significant differences across levels of risk severity within each surgery group. The formula accurately predicted postoperative memory decline among left cases; although 50% of left patients classified as having "mild" risk showed postoperative decline. In contrast, the formula did not accurately predict memory decline in right-sided surgery, although the Ns may have been too small in the "moderate" and "severe" right surgery groups to accurately evaluate degree of risk.

**Conclusions:** Results suggest Stroup's formula for memory outcome after epilepsy surgery is valid for patients undergoing left-sided surgery but should be interpreted with caution in right-sided patients, and left-sided cases with "mild" risk.

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**J. JONES, C. ALLEN, M. SEIDENBERG & B. HERMANN. Daytime Sleepiness in Children and Adolescents with Epilepsy.**

**Objective:** Sleep complaints are frequent among adults and children with epilepsy. Sleep problems have been linked to medications, nocturnal seizures, seizure frequency and endogenous changes in sleep architecture secondary to epilepsy. In the general population there is evidence that increased daytime sleepiness is related to reduced educational achievement and behavioral problems. This study examined the frequency of symptoms of daytime sleepiness in children with epilepsy, and its relationship to behavioral outcomes.

**Participants and Methods:** A series of 57 children with idiopathic epilepsy and 50 healthy first degree cousin controls, age 8-18, participated in a neuropsychological evaluation which included the Child Behavior Checklist (CBCL) completed by each parent, and each child completed the Pediatric Daytime Sleepiness Scale (PDSS). This scale was developed to measure excessive sleepiness in school age populations.

**Results:** Utilizing a cut off score of >16, 28% of children with epilepsy reported increased daytime sleepiness compared to 18% in the controls. Based on the CBCL, children with epilepsy and controls who had daytime sleepiness scored significantly lower on total social competence, had elevated rates of total problems and externalizing symptoms compared to children without sleep problems.

**Conclusions:** Children with idiopathic epilepsies exhibit increased rates of daytime sleepiness compared to controls. The effects of increased daytime sleepiness have comparable effects on behavior in children with epilepsy compared to controls. This increased daytime sleepiness is evident very early in the course of the child's epilepsy and requires further investigation.

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**L.E. MILLER & A.Y. STRINGER. A Comparison Of Configural And Detail Elements Of The Taylor Complex Figure Test in Determining Seizure Laterality.**

**Objective:** Visuospatial memory tests have been less unsuccessful in determining seizure laterality in temporal lobe epilepsy (TLE). As each hemisphere may preferentially encode detail vs. configural elements in complex figures, this distinction may be a basis for determining seizure laterality. The current study utilized a detail vs. configural scoring system for the Taylor Complex Figure Test (TCFT) to lateralize seizure onset, hypothesizing that left TLE would cause poorer detail and right TLE poorer configural recall.

**Participants and Methods:** A panel of four neuropsychologists developed a TCFT scoring system to distinguish detail and configural elements. Inter-rater reliability was tested by two psychometrists independently scoring 20 TCFTs. TCFTs from 48 left and 42 right TLE patients (determined by video-monitored EEG) were subsequently scored by a psychometrist blind to side of seizure onset. Groups were contrasted on potential confounding variables prior to testing study hypotheses.

**Results:** Inter-rater reliability for the TCFT recall trials was 0.956. The TLE groups did not differ significantly in sex, race, months since seizure onset, or IQ. Hence, none of these variables was identified as a potential confound. Right TLE patients after delay recalled more TCFT details than left TLE patients [ $t(88)=-2.15, p<0.03$ ] and had a higher detail to gestalt recall ratio [ $t(88)=-2.29, p<0.02$ ]. Groups did not differ, however, in configural recall.

**Conclusions:** Results suggest the right hemisphere better recalls details in complex figures. While TCFT detail scores can distinguish patients with left TLE, they were unsuccessful in identifying right TLE.

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**A. PAPAZOGLU, T. KING, T. BURNS, R. MORRIS & C. HENRICH. Poor Seizure Control is Associated with Reduced Adaptive Functioning in Children with Epilepsy.**

**Objective:** Children with epilepsy are at risk of suboptimal adaptive functioning, which may adversely affect long-term outcome. Research has not yet quantified how specific seizure and treatment variables may affect adaptive functioning, which would allow clinicians to identify children at risk of suboptimal outcome. This study sought to provide greater detail about adaptive abilities in children with epilepsy, and to identify the seizure and treatment variables most predictive of adaptive functioning.

**Participants and Methods:** Thirty seven children diagnosed with epilepsy were recruited for this study. Mean age at time of assessment was 13.19 years (SD=3.09).

**Results:** Overall adaptive functioning as measured by the General Adaptive Composite (GAC) of the Adaptive Behavior Assessment System-II was found to be in the average range regardless of current treatment status: prescribed one anti-epileptic drug (AED; Mean=94.28, SD=24.65), prescribed multiple AEDs (Mean=90.90, SD=17.84), and post temporal lobectomy (Mean= 91.54, SD=2.90). Using multiple regression analyses, active seizures (1 or more seizures in the prior year) was significantly predictive of the GAC and all three domain scores. The number of current AEDs, past AEDs, number of seizure types, age at

seizure onset, time since seizure onset, and whether a temporal lobectomy was performed were not significantly predictive of adaptive functioning. Our model accounted for 35% of the variance on the GAC, and 38%, 30%, and 35% on the Conceptual, Social, and Practical domains respectively.

**Conclusions:** The findings of this study suggest children with seizures that are not fully controlled are at greater risk of suboptimal adaptive functioning. Clinical implications will be discussed.

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#### C. PARFENE, T.L. STEWART & T.Z. KING. Does Caring for a Child with Epilepsy Lead to Workplace Discrimination?

**Objective:** We examined the extent to which having a child with epilepsy compromises an employee's performance appraisal, workplace rewards, and likelihood of being fired.

**Participants and Methods:** Undergraduate participants (36 men; 11 women) acting as job supervisors reviewed an employee's performance portfolio. According to randomly assigned condition, a form in the portfolio indicated that the employee had taken leave to care for a child with epilepsy (CWE) or asthma (CWA); or, in a third condition, no leave was mentioned. Participants then rated the employee's performance across characteristics and assessed the likelihood that he/she should receive a raise, promotion, or be fired.

**Results:** MANOVA revealed a consistent pattern of bias against employees in the CWE condition, versus those in the CWA and no leave conditions ( $F(3, 41) = 13.36, p < .04$ ). Compared with other conditions, CWE employees received weaker performance ratings ( $F(1, 44) = 4.44, p < .05$ ); lower likelihood of workplace rewards ( $p < .03$ ); and greater likelihood of being fired ( $p < .02$ ). Outcomes for CWA employees did not differ significantly from those who did not take leave.

**Conclusions:** Even when performance records are as strong as that of their peers, employees who take leave to care for a child with epilepsy experience discrimination in the form of lower performance ratings, lower likelihood of workplace rewards, and greater likelihood of being fired. Educational strategies to address epilepsy-based stigma and discrimination, even when employees themselves do not have epilepsy, are discussed.

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#### D.T. PULSIPHER, M. SEIDENBERG, R. SHETH, J. JONES & B. HERMANN. Executive Functioning in Pediatric Epilepsy: A Prospective Longitudinal Study.

**Objective:** Executive dysfunction is reported in chronic localization-related (LRE) and idiopathic generalized (IGE) epilepsy. However, little is known about the longitudinal course of executive functions in new-onset pediatric epilepsy. The purpose of this study was to determine the two year developmental trajectory of executive functions in children with recent-onset (within one year) epilepsy.

**Participants and Methods:** Sixty-five children with recent-onset epilepsy (37 LRE, 28 IGE) and 54 healthy controls were examined. Select subtests from the Delis-Kaplan Executive Function System (D-KEFS) and parent form of the Behavior Rating Inventory of Executive Function (BRIEF) were administered. Subjects were initially tested within one year of diagnosis (baseline) and again two years later (follow-up).

**Results:** At baseline, executive functions were impaired in both IGE and LRE groups compared to healthy controls. However, only the IGE group showed significant improvement on several executive measures at follow-up [ $F(1, 116) = 4.64-7.95, p < .01-.06$ ]. A subgroup of fully remitted subjects (seizure free and off medication at follow-up;  $n = 15$ ) showed both better baseline and follow-up performance on executive measures than a non-remitted group (seizures and medication at follow-up;  $n = 50$ ).  $p$ 's  $< .05$ .

**Conclusions:** The developmental course of executive functions differs between recent-onset LRE and IGE in comparison to one another, although both showed executive dysfunction relative to healthy controls. Children with seizure remission performed similarly to controls at baseline and follow-up. Future work will examine the parallel development of thalamofrontal circuitry that underlies executive functions.

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#### M. RAMIREZ, B.K. SCHEFFT, S.R. HOWE, C. HOVANITZ, H. YEH & M.D. PRIVITERA. Boston Naming Test Performance in Mesial Temporal Lobe and Frontal Lobe Epilepsy: A Quantitative and Qualitative Analysis.

**Objective:** Confrontation naming impairment is a common cognitive morbidity associated with temporal lobe epilepsy (TLE), particularly left TLE. Recent studies indicate that phonemic paraphasic error production on confrontation naming tests also characterize left TLE. However, few studies have investigated the robustness of these findings in comparison to other focal epilepsies. The present study evaluated the predictive ability of the Boston Naming Test (BNT) and the presence of at least one phonemic paraphasic error on the BNT to differentiate frontal lobe epilepsy (FLE) from left TLE, FLE from right TLE, and left from right TLE.

**Participants and Methods:** Seventy-seven individuals with TLE (43 left and 34 right) and 30 with FLE were included. Combination of inpatient video/EEG and MRI assessed by epilepsy experts determined seizure focus. BNT score and phonemic paraphasic error production were obtained from medical records. Binary logistic regression models and area under the ROC curve ( $c$ ) evaluated BNT diagnostic utility.

**Results:** FLE and left TLE patients performed equally poorly on the BNT. Right TLE patient performance was intact. BNT performance best predicted left TLE group membership compared to right TLE ( $OR = 14.20; c = 0.73$ ). It also predicted FLE group membership compared to right TLE ( $OR = 5.52; c = 0.66$ ). Phonemic paraphasic error production differentiated left from right TLE patients. Left TLE patients produced more frequent errors ( $OR = 4.02; c = 0.63$ ).

**Conclusions:** Poor BNT performance does not exclusively indicate a left temporal lobe seizure focus. These results likely reflect the higher incidence of intrahemispheric language reorganization found in intractable epilepsy.

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#### M. RAMIREZ, B.K. SCHEFFT, S.R. HOWE, C. HOVANITZ, H. YEH & M.D. PRIVITERA. Perceived Emotional Distress and Confrontation Naming Performance in Intractable Epilepsy.

**Objective:** Mesial temporal lobe epilepsy (MTLE) patients have higher rates of psychopathology as well as structural hippocampal abnormalities associated independently with the MTLE syndrome and the effects of high levels of emotional distress. Therefore, MTLE cognitive dysfunction may result from some combination of the intrinsic epileptogenic lesion or damage associated with chronic high levels of emotional distress, or both. Confrontation naming is traditionally considered a temporal lobe mediated language domain, but impairment on the Boston Naming Test has been found in both frontal lobe (FLE) and left MTLE patients. This study assessed whether perceived emotional distress moderated FLE and MTLE patient BNT performance.

**Participants and Methods:** Seventy-seven individuals with MTLE (43 left; 34 right) and 30 with FLE were included. Combination of inpatient video/EEG and MRI assessed by epilepsy experts determined seizure focus. Binary logistic regression models were conducted. Main effect and interaction terms for scales D and Pt on the MMPI-2 were added.

**Results:** BNT performance was moderated by perceived emotional distress; however, depression and anxiety differentially affected performance with both suppressive and facilitatory effects relative to seizure focus. Anxiety facilitated FLE patient BNT performance, while depression and anxiety modestly suppressed BNT performance for left MTLE patients.

**Conclusions:** High anxiety may have exerted psychostimulant effects that partially compensated executive dysfunction inherent to FLE. Therefore, poor BNT performance in FLE was likely secondary to primary executive dysfunction, while naming impairment was likely intrinsic to effects of the epileptogenic lesion in left MTLE. Perceived emotional distress appears to be an important treatment consideration for intractable epilepsy patients.

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**G.Z. RECKESS, D. HAMILTON, J. ROBSON, M.D. BARKER, B.C. SACHS, S. EISENSCHENK, S.N. ROPER & R.M. BAUER. Spatial Navigation after Right Anterior Temporal Lobectomy: Mixed Findings Using a Virtual Water Maze.**

**Objective:** The Morris Water Maze (MWM) is a widely used measure of medial temporal lobe (MTL) function in rodents. In humans, the right MTL is believed to contribute to nonverbal learning and recall, including spatial navigation, but behavioral detection of right MTL damage remains elusive. Astur et al. (2002) found that a small sample of post-surgical temporal lobe epilepsy patients performed worse than healthy controls on a computer-based human analogue of the MWM. The current study sought to replicate and extend those findings.

**Participants and Methods:** A computer-based, virtual water maze (NeuroInvestigations Virtual Navigation Morris Water Task) was administered to 14 healthy volunteers and 14 epilepsy patients who had undergone a right anterior temporal lobectomy. On all 8 trials, the platform remained in the same location relative to distal cues; four start locations were used in pseudo-random order. The platform was invisible until found or until 60" expired.

**Results:** Repeated measures ANOVAs revealed no overall between-group differences in learning across trials. However, statistical power was low (.20) and there was notable individual variability within each group: Although some patients demonstrated evidence of learning, the majority did not. Similarly, many healthy participants did not demonstrate consistent learning across trials, though there was a significant overall decrease in path length across trials ( $p < .05$ ).

**Conclusions:** These findings do not support spatial navigation impairment in post-surgical right temporal lobe epilepsy patients. However, the amount of individual variability in both groups suggests that methodological parameters may not have been sufficient to elicit consistent learning in healthy controls. Possible interpretations and limitations are explored.

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**B.C. SACHS, C.C. DOW, M.D. BARKER, G.Z. RECKESS, J. ROBSON, S. EISENSCHENK, S.N. ROPER & R.M. BAUER. Category Specific Naming Deficits for Famous Faces in Post-Surgical Patients with Language-Dominant Temporal Lobe Epilepsy.**

**Objective:** Models of semantic memory suggest that the language-dominant temporal lobe (TL) plays a critical role in the ability to apply verbal labels to objects or concepts, and that focal lesions affecting temporal lobe structures can lead to category-specific deficits in lexical semantics. The TL is also the most common site for the onset of complex-partial seizures, and subsequent resection. This study examined the extent to which category-specific naming deficits exist in post-surgical epilepsy patients.

**Participants and Methods:** We assessed patients (RATL=15; LATL=9) who underwent surgical treatment for refractory epilepsy of either the language dominant (LD) or language non-dominant (ND) TL and healthy controls (N=10). In order to ascertain the degree of category-specific naming deficits in this population, all subjects were administered a standard neuropsychological battery in addition to an experimental, category-specific measure which assessed naming and recognition of famous persons.

**Results:** Patients who had undergone resection of the LD-TL were significantly worse at naming famous persons than were those who underwent resection of the ND-TL ( $p < .05$ ). Both patient groups performed worse than healthy controls. Category-specific naming deficits were more pronounced than deficits for naming of common objects, particularly for patients who underwent LD-TL resections.

**Conclusions:** The results of the current study suggest that category-specific naming deficits exist in post-surgical epilepsy patients with LD-TL resections. This finding highlights the importance of the temporal lobe in semantic memory, particularly for semantically-unique information such as names. The study also reveals that commonly used measures of object naming may not be sensitive to all types of naming deficits present in post-surgical epilepsy patients.

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**L. VAN ITERSAN, L. SAN MIGUEL, M. RIOS, J. RIOS & M. VAZQUEZ. Classificatory Utility of Large Intra-individual WISC-R Variability in Focal Versus Generalized Seizures: Data Across Countries and Cultures.**

**Objective:** Used internationally, the WISC-R emerges as a unique instrument to investigate commonalities across countries. In epilepsy, seizure type is established through EEG and semiology, leaving some diagnoses inconclusive. We explored whether uncommon VIQ-PIQ discrepancy (20 points expected in  $< \sim 10\%$  of normal children) and Factor range (highest minus lowest factor, 28 points:  $< \sim 5\%$ ) would aid in discriminating seizure types across cultures.

**Participants and Methods:** Participants: N=105 children with epilepsy (age 6-16 years, FSIQ $\geq 70$ ). N=64 Dutch (NL); n=47 focal; n=17 generalized seizures. N=41 Puerto Rican (PR); n=27 focal, n=14 generalized. Epilepsy: mean age at onset NL=5.8, PR=4.2; epilepsy duration NL=4.1, PR=2.5.; AEDs>1: NL=50%; PR=7%.

Contrasts: PR versus NL and focal versus generalized groups. GLM-1 or chi-square for WISC-R composite measures and epilepsy variables. Classificatory statistics for large VIQ-PIQ discrepancy and Factor-range.

**Results:** GLM-1 suggests NL/PR equality of WISC-R measures but higher severity of (generalized) seizures in the Dutch.

In NL, VIQ-PIQ 20+ (sensitivity=28%, specificity=94%, Odds ratio=95%CI: .94-27.4) characterize focal seizures due to increased VIQ>PIQ (21%). A similar tendency was seen in PR: VIQ-PIQ 20+ (sensitivity=26%, specificity=86%, Odds ratio=95%CI: .5-7.2). Combined NL+PR was significant for VIQ-PIQ 20+ (27%; 90%, Odds ratio=95%CI 1.0-8.5) and Factor-range 29+: (22%, 97%, odds ratio=95%CI 1.26-39.1).

**Conclusions:** (1) Large intra-individual differences indicated focal rather than generalized seizures.

(2) The results were more robust (and directional) for VIQ-PIQ discrepancy in the Dutch and for Factor range in Puerto Ricans, but suggest generalizability across countries as diverse as The Netherlands and Puerto Rico.

Though earlier onset and longer duration of epilepsy, as well as more AEDs suggest increased severity in the Dutch with generalized seizures, we found overall NL/PR equality of WISC-R and epilepsy measures.

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**L. SEPETA, J. HORSFALL, B. PAUL & S. BOOKHEIMER. Intracarotid Amobarbital Procedure (IAP): Is the Right Hemisphere Wada Test Really Necessary?**

**Objective:** Debate regarding the utility of the right-sided intracarotid amobarbital procedure (IAP) for surgical planning challenges the importance of the right hemisphere injection for determining post-operative risk. This study compared IAPs in adults (17-57 yrs) with right (RTLE) and left (LTLE) temporal lobe epilepsy. We examined the frequency of IAP failure to determine if results precluded standard mesial temporal lobectomy.

**Participants and Methods:** Following anesthetization of the ipsilateral hemisphere with sodium amobarbital, participants (LTLE n=29, RTLE n=22; data collection is ongoing) were presented with six objects and two commands to recall. After recovery, memory was tested using a progressive cueing procedure. A total memory score was calculated, and failure was defined as <66% correct.

**Results:** LTLE patients performed worse than RTLE patients ( $t=2.0$ ,  $p=0.026$ , 1-tailed). Two RTLE (9.1%) and seven LTLE (24.1%) patients failed the IAP. However, for three RTLE patients (13.6%) IAP testing provided information that precluded neurosurgery ( $n=2$ ) or resulted in sparing the mesial temporal area ( $n=1$ ). This was true for three LTLE patients (10.3%) (no neurosurgery:  $n=1$ ; neurosurgery sparing mesial temporal area:  $n=2$ ).

**Conclusions:** Results showing worse performance for LTLE vs. RTLE patients are consistent with the idea that the IAP is most important for LTLE patients; however, for 13.6% of RTLE cases the IAP results changed the surgical plan, i.e. without the IAP these patients may have proceeded to neurosurgery without knowledge of insufficient left hemisphere memory capacity. Therefore, although the utility of right-sided injection is sometimes questioned, preliminary results support the effectiveness of both right- and left-sided injections in surgical planning.

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**E.M. SHERMAN, S. AKDAG, B.L. BROOKS & M.B. CONNOLLY. In the Eye of the Beholder: Discrepancies in Parent and Teacher Ratings of ADHD Symptoms in Children with Epilepsy.**

**Objective:** Parent and teacher rating scales are used for screening of ADHD in many conditions. In community samples, teachers tend to over-report ADHD symptoms compared to parents. Whether this difference also occurs in children with neurological conditions with symptoms that may mimic attentional dysfunction (e.g., seizures) is unknown. We aimed to determine whether parent and teacher ADHD ratings provide similar estimates of ADHD symptom severity and prevalence, and whether these scales had similar associations with neurological status and quality of life in children with epilepsy.

**Participants and Methods:** Scores on the ADHD Rating Scale-IV (ADHD-RS-IV) from 138 children from a tertiary centre were reviewed.

**Results:** Parents rated children as having more severe Inattention and Impulsivity-Hyperactivity compared to teacher ratings, with a two to three times greater prevalence of clinically-elevated Inattention or Impulsivity-Hyperactivity vs. teachers (Total score: 28% vs. 9%). Agreement was best for Impulsivity-Hyperactivity, with 80% of children falling in the same clinical classification (normal vs. clinically-elevated), but low for Inattention, where 30% of children with normal teacher ratings were rated as having clinically-significant impairments by parents. Parent ratings were not related to neurological correlates, but teacher ratings correlating with age at epilepsy onset. Notably, both parent and teacher ADHD ratings were related to quality of life, providing evidence for parent/teacher construct overlap.

**Conclusions:** Parents of children with epilepsy provided much higher ratings of ADHD symptoms compared to teachers, the opposite of what is found in community samples of children with primary ADHD. More research is needed to determine whether the use of parent ratings may raise the risk of ADHD over-diagnosis in children with epilepsy.

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**A. SOPER, M.T. WAGNER, K. TOPPING & P.B. PRITCHARD. Transient Epileptic Amnesia: A Case Series of a Treatable Memory Disorder.**

**Objective:** Patients with treatable memory disorders are rare. One memory disorder that is potentially treatable with antiepileptic drugs (AED's) is transient epileptic amnesia (TEA). TEA was originally designated as epileptic amnesic attacks by Pritchard et al. (1985). TEA represents episodic memory dysfunction with preserved sensorium caused by epileptiform activity. TEA usually affects structures of the mesial temporal lobe. Because there are rare descriptions and no incidence or prevalence data on the syndrome, we present a case series of a treatable form of memory loss with clinical and theoretic importance.

**Participants and Methods:** Archival review of serial admissions identified 5 adults diagnosed with TEA based on the diagnostic results of neurological/neuropsychological exams and EEG recordings.

**Results:** In all cases, TEA was the only epileptic manifestation. Age of onset ranged from 46 to 78. In 3 cases, abnormal EEG with temporal lobe discharge was shown. Of these, 2 cases also showed left frontal sharp wave epileptiform activity. No clear pattern of impairment emerged upon neurocognitive testing. All cases exhibited vascular risk factors. In 4 cases, TEA remitted with AED treatment. One intractable case is under surgical consideration.

**Conclusions:** We present the working consensus diagnostic criteria for TEA and highlight the syndrome with a case series. We have one case of treatment refractory TEA that is currently being considered for neurosurgical treatment, and this has never been reported before in the literature. Correspondence: Ana Soper, MA, Psychiatry, Medical University of South Carolina, 165 Cannon Street, MSC 852, Charleston, SC 29425. E-mail: soper@musc.edu

**V.N. TUCHSCHERER, D. PULSIPHER, S. MICHAEL, L. GUIDOTTI, M. LANCASTER & B. HERMANN. Role of Thalamic Volume in TLE Memory Performance.**

**Objective:** Thalamic volume loss in temporal lobe epilepsy (TLE) has been reported and has been shown to be associated with memory performance. Here we examined the longitudinal (four-year) memory performance of unilateral TLE patients and its relationship to baseline hippocampal and thalamic volumes.

**Participants and Methods:** WMS-III performance of 50 TLE patients (mean age = 38.1) was examined at baseline and at 4-year follow-up. No patients underwent surgery in the test-retest interval. A series of regression analyses were conducted to determine the association of baseline hippocampal and thalamic volumes to delayed verbal and visual memory performance at retest.

**Results:** Left hippocampus and left thalamus at baseline are both significant predictors of verbal and memory performance four years later. Together they accounted for 24 percent of the variance in predicting verbal memory performance ( $p = .001$ ). Hippocampus volume accounted for 14 percent variance ( $p = .006$ ) and thalamus accounted for 10 percent ( $p = .02$ ). For visual memory, hippocampus and thalamus volumes together accounted for 34 percent of the variance ( $p < .001$ ), with hippocampus contributing 11 percent of the variance ( $p = .02$ ) and thalamus contributing 23 percent ( $p < .001$ ).

**Conclusions:** These findings reiterate the role of the left hippocampus in memory performance in TLE. In addition, the predictive role of thalamic volume for memory performance goes beyond that of hippocampal volume suggesting that the thalamus plays a significant role in memory performance in TLE.

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**T.A. ZABEL, J. REESMAN, E. WODKA, R. GRAY, L. FERENC & A. COMI. Neuropsychological distinctions in patients with Sturge-Weber Syndrome and posterior versus diffuse MRI findings: Four case reports.**

**Objective:** Sturge-Weber syndrome (SWS) is a rare neurocutaneous disorder associated with seizures and varying degrees of abnormal cortical vascular development and/or calcification. MRI abnormalities typically involve parietal-occipital regions but can also extend into frontal and temporal cortices. This case series was a preliminary examination of possible linkages between degree of cortical involvement and neuropsychological presentation in SWS.

**Participants and Methods:** Four patients (ages 8-9) with SWS were selected from a research database to represent the range of cortical involvement in this clinical population. Patients 1 and 2 (both RH females) were less severe in neurologic presentation and had primarily posterior MRI findings (Patient 1: mild bilateral posterior; Patient 2: left-sided posterior). Patients 3 (LH male) and 4 (RH male) had more severe neurologic presentations (increased seizures and stroke-like episodes), and had more diffuse MRI findings (Patient 3: left-sided diffuse; Patient 4: bilateral diffuse).

**Results:** Widespread neuropsychological deficits (visual-perceptual, language, memory, executive) were observed in those patients with the most extensive MRI findings (Patients 2-4), while Patient 1 had no abnormal test scores. Despite a degree of left-hemisphere involvement in all four SWS patients, those individuals with posterior (versus diffuse) MRI findings (Patients 1 and 2) had higher levels of parent-reported adaptive functioning and stronger performance on frontally-mediated tests of working memory and verbal (letter-word) fluency.

**Conclusions:** While other SWS-related variables must be considered (e.g., seizure control, medication side effects, hemiparesis, glaucoma), these preliminary findings suggest increased neuropsychological and executive disruption posed by the extension of SWS vascular and cortical abnormalities into frontal and temporal regions.

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### Multiple Sclerosis/ALS/Demyelinating Disorders

**C.R. ANDERSON, J.A. CLARK & B.A. PARMENTER. The Role of Executive Functioning in Verbal Memory in Patients with Multiple Sclerosis.**

**Objective:** Verbal learning and memory can be affected by deficits in other cognitive domains, including processing speed, working memory, and higher executive functions. The goal of this study was to examine if verbal learning and memory deficits seen in patients with multiple sclerosis (MS) are related to impairments in these other areas of cognition.

**Participants and Methods:** Forty-three MS patients (age:  $M = 47.05$ ,  $SD = 9.62$ ; education:  $M = 15.05$ ,  $SD = 2.07$ ) completed the California Verbal Learning Test-II (CVLT-II), the Delis-Kaplan Executive Functions System (DKEFS) Sorting Test, the oral version of the Symbol Digit Modalities Test (SDMT), and the Paced Auditory Serial Addition Test (PASAT) as part of a larger cognitive battery. Total learning and long delay free recall from the CVLT-II were used as the criterion variables.

**Results:** Multiple regression analyses showed that age and the DKEFS total correct sorts (CS) were the only significant predictors of CVLT-II total learning ( $\beta = -.436$ ,  $p = .003$  and  $\beta = .488$ ,  $p = .000$  respectively). The DKEFS CS was the only significant predictor of CVLT-II long delay free recall ( $\beta = .445$ ,  $p = .003$ ). Total correct on the SDMT and the PASAT were not significant predictors ( $p > 0.05$ ) for either memory variable.

**Conclusions:** These results suggest that verbal learning and memory deficits commonly seen in MS are related more to impairment in executive function than to deficits in processing speed, working memory, or a combination of these cognitive functions.

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**F. BARWICK & P. ARNETT. Do Patient and Significant Other Ratings of Vegetative Depression Symptoms Reflect Limitations in MS Patients' Physical Activity and Mobility?**

**Objective:** In neurological populations, patient (PT) ratings of vegetative depression symptoms can reflect real limitations in physical activity or mobility. How similarly significant other (SO) ratings reflect such limitations was examined in patients with multiple sclerosis (MS).

**Participants and Methods:** 101 MS PTs were administered the vegetative subscale of the Chicago Multiscale Depression Inventory (MDI), the Sickness Impact Profile (SIP), the FAMS mobility subscale, and the Expanded Disability Status Scale (EDSS). SOs identified by PTs completed the MDI. Correlations between PT- and SO-rated vegetative symptoms, patient-reported physical activity, and neuro-psychologist-rated mobility were examined. High-low groups were created using both PT and SO vegetative symptom ratings. High-low groups were compared on reported levels of physical activity and mobility.

**Results:** In the overall MS sample, PT- and SO-rated vegetative symptoms were significantly correlated with physical activity and mobility ( $r = .38-.40$  for PTs and  $.28-.27$  for SOs, all  $p < .01$ ). Both PT and SO ratings explained a significant amount of variance in physical activity and mobility in a hierarchical regression model ( $R^2 = .23$  for PTs and  $.17$  for SOs, both  $p < .01$ ). When high-low groups were created using PT and SO vegetative symptom ratings, only SO-defined groups differed significantly on physical activity and mobility ( $F(1, 27) = 19.1$ ,  $p < .01$ ).

**Conclusion:** In a community MS sample, PT- and SO-rated vegetative depression symptoms are similarly associated with patient and neuro-psychologist reports of limitations in physical activity and mobility. However, in groups reporting high or low levels of vegetative symptoms, SO ratings more accurately reflect patients' actual and reported physical limitations.

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**M.R. BASSO, P. CANDILIS, T. WARD, R. SHIELDS, I. SHIELDS, V. TRACY, A. NELSON, D. COMBS, P. ARNETT & J. JOHNSON. Neuropsychological Impairment and Major Depression Compromise Medical Research Decision-Making Capacity in Multiple Sclerosis.**

**Objective:** Medical research subjects must be able to express a choice whether to participate, as well as appreciate, understand, and reason through proposed research details (Grisso & Appelbaum, 1998). Our research shows that multiple sclerosis (MS)-related cognitive impairment compromises ability to consent to research participation. Depression occurs commonly in MS and corresponds with cognitive impairment and functional deficits. The present study examined whether depression contributes to compromised medical decision-making.

**Participants and Methods:** Participants were administered a broad battery of neuropsychological tests and a modified MacArthur Competence Assessment Tool for Clinical Research (MacCAT-CR), which includes measures of understanding, appreciation, judgment, and expression of choice (Grisso & Appelbaum, 1998). Depression was assessed with a structured diagnostic interview.

**Results:** MacCAT-CR scores were regressed upon the impairment index, ambulation index, sex, age, education, depression, and the interaction of depression and impairment. Depression and impairment were significant predictors of misunderstanding. Their interaction was not significant. Only impairment predicted appreciation and reasoning.

**Conclusions:** Cognitive impairment and depression may compromise capacity of MS patients to understand medical procedures, thereby making them incapable of consenting to research participation and medical treatment. Surprisingly, depression did not exacerbate the impact of neuropsychological impairment upon decisional capacity. Collectively, these data imply that only some people with MS are incapable of providing informed consent to research participation, and they will be characterized by depression and neurobehavioral dysfunction.

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**M.R. BASSO, D. COMBS, P. CANDILIS, A. NELSON, R. SHIELDS, I. SHIELDS, T. WARD, V. TRACY, J. JOHNSON & P. ARNETT. Emotion Perception Deficits Correlate with Compromised Social Functioning in Multiple Sclerosis.**

**Objective:** Cognitive impairment is common in multiple sclerosis (MS), but disease effects on social cognition are uncertain. Emotion perception is presumed necessary for interpersonal relations, and frontal lobe structures are important neural substrates for this function. Beatty et al. (2003) found impaired prosody in some patients, but no investigation has studied facial affect perception in MS. The present investigation assessed the correlates of facial affect recognition in MS. Because depression is a common correlate of impairment and social cognition, its effects were also examined.

**Participants and Methods:** 82 people with MS were administered Facial Emotion Identification Test (FEIT) and a broad battery of neuropsychological tests. Measures of depression, social, and adaptive function were also administered.

**Results:** On the FEIT, 38% of the MS patients performed at least 1 SD below normal, and 18% scored 2 SD lower normal. Thus, facial affect recognition was poor in a substantial subset of the sample. FEIT correlated with executive function and working memory (range = .2-.3), but simple visual discrimination skill did not. Multiple regression revealed that cognitive impairment corresponded with activities of daily living, but FEIT and depression predicted social functioning.

**Conclusions:** To our knowledge, these data are the first to demonstrate impaired facial affect recognition in MS. This deficit corresponded with impaired executive function and working memory as well as a measure of social functioning. This pattern of data supports assertions that frontal regions are the neural substrate for facial affect recognition and emotion perception. Implications of these data for future research and clinical practice are discussed.

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**B.C. BAUGHMAN, M. BASSO & R. SINCLAIR. Staying on the Job: Correlates of work performance among employed M.S. patient.**

**Objective:** Most people with multiple sclerosis (MS) become unemployed shortly after diagnosis, and physical disability and neuropsychological impairment have emerged as potent predictors of unemployment. Nonetheless, little is known about factors that predict job performance among MS patients who remain employed.

**Participants and Methods:** 18 M.S. patients completed measures of attention (digit span), verbal memory (CVLT-II), and executive function (verb fluency). Additionally, participant and employer-appraised occupational performance ratings were obtained. Occupation ratings were based on two distinct measures (Sinclair Performance Inventory and Work Behavior Inventory), which assess multiple aspects of work performance according to accepted models of performance appraisal.

**Results:** Although participants reported modest physical symptoms, a wide range of neurocognition was evident, with some patients manifesting considerable impairment. The three cognitive measures, job tenure, job complexity, and a measure of ambulation served as independent variables, whereas, sub-domains of the work performance measures served as dependent variables. Regression analyses revealed that performance on cognitive measures accounted for the greatest amount of variance in performance ratings. Additionally, neuropsychological performance consistently accounted for discrepancies between participant and employer ratings.

**Conclusions:** Overall, the results support previous studies suggesting the importance of cognitive factors in employment. Moreover, this study extends previous research by demonstrating the relative effect of spe-

cific neurocognitive domains on work performance. Notably, simple attention emerged as the most robust correlate of performance and performance discrepancies, followed closely by executive function. Implications for future research, rehabilitation and general societal impact for employed individuals with M.S. are discussed.

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**J. BRUCE, J. JACOBSON, S. PETERSON, L. BRATCHER, E. GUSE, J. FRITZ & S. LYNCH. The relationship between self-report and objective measures of medication adherence in relapsing-remitting multiple sclerosis.**

**Objective:** Poor medication adherence is commonplace and contributes to poor health outcomes among numerous patient populations. Few studies have described rates of adherence to medication in MS. Studies that have examined treatment adherence in MS focus exclusively on imprecise retrospective self-reports. To help address this methodological limitation, the present longitudinal study compared adherence outcomes for MS patients using retrospective self-reports, adherence diaries, and objective electronic monitoring devices.

**Participants and Methods:** 26 relapsing-remitting MS patients were recruited from an MS clinic. Patients initially reported how frequently they missed doses of their glatiramer acetate in the previous 8 weeks. Patients were then followed for 8 weeks during which they used a medication log and a sharps container that electronically recorded the time and date of each needle disposal.

**Results:** Self-reported adherence was significantly correlated with adherence measured by medication logs ( $r = .57, p < .01$ ) and electronic monitoring devices ( $r = .69, p < .001$ ). Self-reported adherence (Mean Doses Missed (MDM) = 3.27%, SD = 4.68) was significantly higher ( $p < .05$ ) than adherence measured by medication logs (MDM = 8.39%, SD = 14.91) and electronic monitoring devices (MDM = 8.77%, SD = 12.70).

**Conclusions:** Self-report, prospective, and objective measures of adherence were significantly correlated. Nonetheless, MS patients' reported significantly higher rates of adherence than indicated by their medication logs and electronic monitoring devices. Building upon these methodological advances in adherence monitoring, future neuropsychological studies should examine whether cognitive and emotional difficulties impact adherence in MS.

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**E. CAPILI, H.M. GENOVA, G. WYLIE, N.D. CHIARAVALLI & J. DELUCA. Cognitive Fatigue in Multiple Sclerosis Using fMRI: a Pilot Study Examining the Relationship Between Objective and Subjective Measures.**

**Objective:** Fatigue is prevalent in individuals with multiple sclerosis (MS). A significant association between an objective measurement and self-perceived feelings of cognitive fatigue has yet to be firmly established. We hypothesized that increased cerebral activation, assessed by fMRI, might be a valuable objective measure of cognitive fatigue. Here we examined the relationship between increased cerebral activation induced by a mentally effortful task with self-reported ratings of cognitive fatigue in MS.

**Participants and Methods:** Six individuals with MS completed a fatiguing task (modified version of Symbol Digit Modalities Task) and a non-fatiguing task while undergoing fMRI. Subjective ratings of cognitive fatigue, mood, and pain were collected via Visual Analogue Scales before and after each trial of the two tasks. Multiple regression and random-effects analyses were performed to isolate regions uniquely associated with cognitive fatigue.

**Results:** A random-effects analysis revealed that activation uniquely associated with self-ratings of fatigue (and not pain or mood) occurred in several areas hypothesized to be associated with fatigue, including superior and medial frontal gyri, posterior cingulate, and caudate. This activation was evident during the cognitively fatiguing task, but not during the non-fatiguing task.

**Conclusions:** This is the first study to correlate subjective fatigue with cerebral activation which reflects cognitive fatigue induced by objective behavioral performance on a cognitive task in MS, unconfounded by pain or mood. The finding that activation uniquely related to cognitive fatigue was found in areas associated with fatigue in previous studies suggests that fMRI provides a robust method for understanding cognitive fatigue and its underlying neurobiological mechanisms in MS. Correspondence: *Emlyn Capili, B.A., Neuropsychology and Neuroscience Laboratory, Kessler Foundation Research Center, 300 Executive Drive, Suite 150, West Orange, NJ 07052. E-mail: ecapili@kesslerfoundation.net*

**L.J. JULIAN, C. LANDE, V. GREENFIELD & D. MOHR. Associations among Neurological Disability, Cognitive Dysfunction, and Longitudinal Outcomes in Multiple Sclerosis.**

**Objective:** The purpose of this study was to determine the relationships among cognitive dysfunction, neurological status, and overall disability in a longitudinal study of persons with multiple sclerosis (MS).

**Participants and Methods:** Participants include 132 persons with MS participating in an ongoing longitudinal study of structural brain abnormalities and neurobehavioral symptoms. Neurological status was evaluated by physician and patient ratings. Cognitive measures included California Verbal Learning Test-II, Symbol Digit Modalities Test, D-KEFS Trail Making, Verbal and Design Fluency. Depressive symptom severity was assessed by the Center for Epidemiological Studies – Depression scale (CESD). Global disability was determined by the Environmental Status Scale (ESS).

**Results:** Mean age=45.2±9.7 years, education=16.4±2.5 years, 72% female, 93% Caucasian, assessment interval =12 months, and 92 participants completed longitudinal assessments. Regression analyses suggest that measures of memory, executive functioning, and depression significantly contributed to disability after accounting for neurological status [ $R^2=.44$ , adjusted  $R^2=.39$ ,  $F(4,108)=4.5$ ,  $p<.05$ ]. Paired t-tests suggest no significant group declines on cognitive measures over 1 year. Multivariate analysis revealed that lower baseline neurological functioning was associated with a trend level with more rapid cognitive deterioration over the course of one year (rANCOVA,  $\Lambda=0.94$ ,  $F(1, 60)=3.05$ ,  $p=.07$ ).

**Conclusion:** In this study neurological status, cognitive functioning and mood at baseline predicted overall disability in several domains (work decline, increased assistance required, social and community involvement, etc.). Participants were not observed to decline significantly on cognitive measures over the course of approximately 1 year; however, poorer baseline neurological functioning may signal a more rapid decline in this population. Correspondence: *Laura J. Julian, Ph.D., Medicine, University of California San Francisco, 3333 California Street, Suite 270, San Francisco, CA 94143-0920. E-mail: laura.julian@ucsf.edu*

**S. KURTZ, T. LEE-WILK, C. BEVER, W. ROYAL, M. WALLIN, H. MALONI & R.L. KANE. The Relationship between Global Neurological Impairment and Neuropsychological Functioning using Computerized Testing in Multiple Sclerosis.**

**Objective:** Patients with Multiple Sclerosis (MS) experience symptoms in a number of neurological domains. These can be quantified using the Kurtzke Expanded Disability Status Scale (EDSS), a standardized measure of global neurological impairment in MS. An estimated 45-65 % of MS patients experience cognitive impairment. The Remote Automated Neuropsychological Assessment Metrics (ANAM™) is an internet-based measure sensitive to cognitive impairment in MS. Some studies have linked EDSS scores to cognitive functioning in MS using traditional paper-and-pencil neuropsychological tests, although findings have been mixed. The current study examined the relationship between EDSS and cognitive functioning in MS using the computerized ANAM test battery.

**Participants and Methods:** Participants were recruited from the VA MS Center of Excellence East (N=63). All participants were assigned an EDSS score by a physician and completed the ANAM test battery

within a 2 week period. Linear regressions were conducted examining the relationship between EDSS and a global measure of neurocognitive functioning (Index of Cognitive Efficiency; ANAM ICE) and between EDSS and certain individual ANAM tests, controlling for demographic variables.

**Results:** EDSS did not significantly predict the ANAM ICE score. However, EDSS was a significant predictor of Simple Reaction Time ( $p=.03$ ) and Procedural Reaction Time ( $p<.01$ ) tests. There was also a trend towards significance for Running Memory CPT test ( $p=.09$ ).

**Conclusions:** EDSS scores predicted performance on individual ANAM tests that utilize attention, processing speed, and working memory. These results suggest that neurological impairment in MS is associated with specific rather than global impairments in cognitive functioning.

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**S.A. MORROW, T. KAUSHIK, D. ERLANGER, F.E. MUNSCHAUER & R.H. BENEDICT. Efficacy and Safety of l-Amphetamine Sulfate on Cognitive Function in MS Patients.**

**Objective:** Defects in processing speed, working and episodic memory are common in multiple sclerosis (MS) but few treatments are available. We endeavored to assess the safety and efficacy of l-amphetamine sulfate for cognitive dysfunction in MS.

**Participants and Methods:** 151 MS patients with documented cognitive dysfunction (108 active, 48 placebo) aged 18-65 were randomized (2:1 ratio) to receive 30mg of l-amphetamine or placebo. Dependent measures were Symbol Digit Modalities Test (SDMT), Paced Auditory Serial Addition Test (PASAT), total learning (TL) and delayed recall (DR) indices of the California Verbal Learning Test second edition (CVLT2) and the Brief Visuospatial Memory Test – Revised (BVMTR). Patients were assessed at baseline and after one month of treatment. Treatment effects were measured via ANCOVA, with post-treatment means serving as the dependent variable and baseline scores as a covariate.

**Results:** 137 subjects completed the study. The two groups were well matched on gender, ethnicity, age, MS type and education. At baseline, there was no difference between active ( $n=100$ ) and placebo ( $n=37$ ) groups on neuropsychological tests. After treatment, the active group performed significantly better on BVMTR-TL ( $p = 0.041$ ), BVMTR-DR ( $p = 0.009$ ) and CVLT2-DR ( $p = .012$ ). Only 5 patients (4 treatment group, 1 placebo) withdrew due to serious or intolerable adverse events, with no other side effects reported.

**Conclusions:** L-amphetamine sulfate demonstrated improved learning and memory and was well tolerated, thus showing promise for treating cognitive dysfunction in MS. Possible models regarding the mechanism of action and neuropharmacology will be discussed.

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**A.R. RABINOWITZ & P.A. ARNETT. Mediators of MS Symptoms' Effects on Contentment.**

**Objective:** The current study was designed to assess possible mechanisms by which MS symptoms negatively impact general contentment. Four MS symptom domains—ambulation-motor, bladder-bowel, weakness-paresthesias, and fatigue—were considered in three separate models examining possible mediators. Sickness impact on sleep and recreational activities were evaluated as behavioral mediators; an index of MS related attitudes was evaluated as a cognitive mediator.

**Participants and Methods:** Seventy-seven MS patients were administered the Multiple Sclerosis Symptom Severity Scale (MS-SSS), the Functional Assessment of MS (FAMS), the Multiple Sclerosis Attitudes Index (MSAI), and the Sickness-Impact Profile (SIP). Path models were created using Mplus. In all models, MS-SSS subscales for the aforementioned symptom domains indicated a latent predictor variable; the FAMS general contentment subscale was included as the outcome. MSAI score, SIP sleep and rest, and SIP recreation and past-times subscales were evaluated as mediators.



**Results:** The model including the MSAI as a mediator had adequate model fit, and best comparative fit (CFI = .95; SRMR = .08). The models including sickness impact on recreational activities (CFI = .86; SRMR = .15) and sleep (CFI = .82; SRMR = .16) demonstrated poorer fit, with indices falling short of the criteria for adequate model fit.

**Conclusions:** These results suggest that MS symptoms may lead to poorer quality of life via their impact on cognitive factors—attitudes of learned helplessness and lack of control, and not behavioral factors like sickness impact on sleep and recreational activities. It is possible that therapeutic interventions targeting MS related attitudes may improve patients' contentment.

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**A.M. STRUTT, J. PALCIC, J.G. WAGER, C. TITUS, Y. HARATI, P.E. SCHULZ & M.K. YORK. Respiratory Function is not Related to Cognitive Impairment in Patients with Amyotrophic Lateral Sclerosis (ALS).**

**Objective:** Clinically significant cognitive declines have been found in individuals diagnosed with Amyotrophic Lateral Sclerosis (ALS). Recent research has suggested that cognitive impairment in ALS patients may be related to declines in respiratory function. However, studies examining this association have not reached a definite conclusion. This study examined the relationship between respiratory function and cognition in a large cohort of ALS patients.

**Participants and Methods:** Forty patients from Baylor College of Medicine's ALS Clinic underwent comprehensive neurological work-ups, including a pulmonary functioning evaluation, and a comprehensive neuropsychological assessment. ALS patients were grouped based on their respiratory scores [with (n=13) and without (n=27) respiratory impairment].

**Results:** No significant between group differences on demographic variables including age, sex, site of disease onset, education, and ethnicity were found. Respiratory scores and neuropsychological measures were not significantly correlated. No significant differences on tests of attention, working memory, information processing speed, verbal and visual memory, and higher order cognitive functioning were found between groups.

The number of ALS patients with subtle cognitive decline did not differ between the groups (impaired: 23%; non-impaired respiration: 26%). Moreover, the number of ALS patients with significant cognitive impairment also did not differ between those with and without respiratory changes (69% and 56%, respectively).

**Conclusions:** Changes in cognitive decline appear to be related to the ALS disease process and not to the respiratory changes associated with the disease. Current findings are supported by research that reports a lack of cognitive improvement with the use of respiratory interventions. Correspondence: *Adriana M. Strutt, Ph.D., Neurology, Baylor College of Medicine, 6501 Fannin MS NB: 302, Houston, TX 77030. E-mail: adrianam@bcm.edu*

**J.F. SUMOWSKI, N. CHIARAVALLI & J. DELUCA. Cognitive Reserve Protects Against Learning and Memory Dysfunction in Multiple Sclerosis.**

**Objective:** Cognitive Reserve (CR) represents premorbid neural efficiency / capacity, often estimated with proxies of premorbid IQ. Research has shown that when cognition is challenged by neurologic disease (e.g., Alzheimer's Disease), persons with higher CR cope better with increased demands, thereby avoiding / delaying cognitive impairment. This is the first study examining the effect of CR on verbal learning and memory in Multiple Sclerosis (MS). It was hypothesized that persons with MS would perform worse than HC's at lower levels of CR; however, this discrepancy should narrow as CR increases and disappear at higher levels of CR.

**Participants and Methods:** Fifty-eight persons with MS (Age = 46.6 ± 7.7; Disease Duration = 9.9 ± 7.7 years) and 43 HC's (Age = 43.1 ±

11.2) completed the WRAT-3 Reading Subtest to estimate premorbid CR, and WMS-R Logical Memory subtests to measure verbal learning and memory. Separate multiple regression analyses predicting learning and memory consisted of 4 Blocks: (1) Age, (2) Group, (3) CR, and (4) Group X CR Interaction.

**Results:** MS diagnosis and lower CR both predicted worse learning and memory ( $p$ 's < .05), but these effects were moderated by significant Group X CR interactions ( $p$ 's < .05) such that persons with MS demonstrated learning and memory deficits at lower levels of CR, but these deficits disappeared at higher levels of CR. In fact, persons with MS performed comparably to HC's at higher CR levels.

**Conclusions:** Higher CR protects persons with MS from disease-related verbal learning and memory dysfunction.

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**J.F. SUMOWSKI, G. WYLIE, N. CHIARAVALLI, H. GENOVA & J. DELUCA. Functional Neuroimaging of Cognitive Reserve in Multiple Sclerosis: Implications for the Default Mode Network.**

**Objective:** The "default mode network" consists of brain regions (posterior cingulate / precuneus and ventral anterior cingulate) that are active during rest and that show progressively less activation as cognitive demands increase. Cognitive Reserve (CR) refers to premorbid neural efficiency / capacity, estimated with educational attainment and premorbid intelligence. This study investigated whether higher CR among persons with Multiple Sclerosis (MS) was associated with greater cerebral efficiency as evidenced by maintenance of default mode network activation despite increasing task demands.

**Participants and Methods:** fMRI data were acquired from 12 women with Relapsing Remitting MS (age = 40.9 ± 8.3; disease duration = 8.1 ± 7.8 years) during the N-Back working memory task. A CR component score was derived from WASI Vocabulary raw scores and years of education. Separate 3D whole brain regressions were performed to identify the relationship between CR and percent signal change for each N-Back condition while controlling for age, disease duration, and multiple comparisons.

**Results:** CR was positively associated with activation of the default mode network during the 0-Back ( $p$  < .005), 1-Back ( $p$  < .01), and 2-Back ( $p$  < .01). During the 2-Back, there were also negative associations between CR and activation of the left middle and superior frontal gyri and premotor cortex ( $p$  < .025).

**Conclusions:** Higher CR is associated with greater cerebral efficiency among persons with MS, characterized by maintenance of default mode network activation and less additional recruitment of frontal regions as task demands increased. This is also the first known evidence that CR moderates default mode network activation.

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**L.H. SWEET, S.D. VANDERHILL, B.A. JERSKEY & D.M. COTE. Cognitive Processing Speed and Verbal Working Memory in Multiple Sclerosis.**

**Objective:** Impaired cognitive processing speed and verbal working memory (VWM) are common in Multiple Sclerosis (MS). In fact, global processing speed deficits might cause other cognitive impairments observed in MS. This study was designed to dissociate VWM components among MS patients. Of two frequently studied VWM sub-components, sub-vocal rehearsal was expected to be more affected than short-term memory buffering. Worse sub-vocal rehearsal was predicted to be related to slowed processing.

**Participants and Methods:** Fifteen relapsing-remitting MS patients (four male, mean age=42.76, mean education=14.33) performed a 2-

Back VWM task with modified nested conditions designed to increase articulatory rehearsal (via inter-stimulus interval) and short-term memory demands (via phonological similarity). A neuropsychological battery assessing 23 measures of VWM, processing speed, attention, mood, and fatigue was also administered.

**Results:** The oral Symbol Digit Modalities Test was related to performance on the rehearsal 2-Back (accuracy:  $r=.54$ ,  $p=.03$ ; reaction time:  $r=-.46$ ,  $p=.07$ ) and 18/23 neuropsychological measures ( $p<.05$ ). Although accuracy did not differ, reaction time (RT) during the rehearsal condition tended to be slower (than the traditional  $p=.046$  and similarity 2-Back  $p=.072$ ). Better neuropsychological performance was significantly related ( $p<.05$ ) to faster RT (10/23 measures), increased accuracy (14/23 measures), or both (6/23 measures) during the rehearsal manipulation. Performance during the other 2-Back conditions was only related to 2/23 (psychomotor) measures. Age and education were not significantly related to 2-Back performance during any condition.

**Conclusions:** Findings suggest that VWM impairments in MS may be specifically related to sub-vocal rehearsal deficits associated with slowed cognitive processing, which also has a major impact on other neuropsychological domains.

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#### G.A. VARGAS & P.A. ARNETT. Social Support and Uplifts Interact to Predict Depression in Patients with Multiple Sclerosis.

**Objective:** Both social support and stress have been found to predict depression in Multiple Sclerosis (MS) patients. However, little work has been done on the relationship between presence or absence of positive life experiences and depression in this group.

**Participants and Methods:** 93 MS patients completed the Social Support Questionnaire (SSQ), the Hassles and Uplifts Scale (HUS), and the Chicago Multiscale Depression Inventory (CMDI). For the SSQ, a composite score was calculated by multiplying the average number of supports by the average satisfaction with these supports. For the HUS, separate summed scores for hassles and uplifts were created. For the CMDI, Mood and Evaluative scales were combined. Separate regression analyses were conducted with the SSQ entered at step 1, either the hassles or uplifts score at step 2, and the interaction term at step 3 to predict depression.

**Results:** The hassles score did not interact significantly with level of social support to predict depression. However, when the same regression analysis was run using the uplifts score, social support and uplifts interacted significantly to predict depression. After considering significant main effects, the interaction of uplifts and social support accounted for nearly 6% independent variance in depression ( $p<.05$ ).

**Conclusions:** These results suggest that the absence of uplifts, combined with low levels of social support, can contribute to depression in MS patients. More generally, these data indicate that it is important to study the absence of positive factors along with the presence of negative factors in these patients' lives.

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### Other

#### C. BENJAMIN, A. WOOD, M. SALING & D. REUTENS. The space and time of memory: Spatial and temporal binding in healthy adults and left Temporal Lobe Epilepsy.

**Objective:** The process of binding different forms of information is a key function of the brain. This ability to associate arbitrary information occurs in both perception and cognition, and must underlie processes including learning, memory, and conscious experience. Two particularly interesting forms of binding include the ability to associate spatial and temporal information. We developed a cognitively simple visual paradigm to examine these processes.

**Participants and Methods:** We used a jittered event-related fMRI design in a group of patients with left TLE ( $n=14$ ) and controls ( $n=15$ ) to examine these abilities within the visual modality. Analysis focussed upon brain areas engaged when information was correctly bound for later recall.

**Results:** Results indicate engagement of frontal regions in temporal binding, and are suggestive of mesial temporal involvement in spatial binding. Left TLE patients demonstrated a differing pattern of frontal and temporal activity to controls.

**Conclusions:** These results and their relationship to our developing knowledge of binding and episodic memory will be discussed.

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#### M. DI PINTO, H.M. CONKLIN, C. LI, X. XIONG & T.E. MERCHANT. An Investigation of Verbal Learning and Visual-Auditory Learning after Conformal Radiation Therapy in Children with Localized CNS Tumors.

**Objective:** This study examined the longitudinal effects of conformal radiation therapy (CRT), a technique that concentrates radiation on the tumor while sparing surrounding healthy tissue, on verbal and visual-auditory learning in children with localized primary CNS tumors. Learning risk factors were also examined.

**Participants and Methods:** The total sample consisted of 161 patients [53 low grade glioma (LGG); 71 ependymoma, 27 craniopharyngioma]. Learning measures included the California Verbal Learning Test – Children's Version (CVLT-C) and the Visual-Auditory Learning Test (VAL) of the Woodcock-Johnson Cognitive Battery: Revised. Patients were tested prior to CRT, at six months and then yearly for 5 years after CRT.

**Results:** Linear mixed models revealed verbal and visual-auditory learning to be stable over time in all tumor groups after CRT (slope estimates ranged from  $+0.013$  to  $+0.081$  percent/month). However, several risk factors were found that adversely affected learning (hydrocephalus, shunt insertion and number of surgeries). Shunt insertion posed significantly greater risk for adverse outcome in the craniopharyngioma tumor group. Furthermore, younger age at the time of treatment had a significant adverse effect on visual-auditory learning in the craniopharyngioma ( $p = .025$ ), ependymoma ( $p = .001$ ) and LGG ( $p = .030$ ) tumor groups, but only the ependymoma group for verbal learning ( $p = .008$ ).

**Conclusions:** In general, visual-auditory learning was more vulnerable to adverse outcomes than verbal learning. Some risk factors (e.g., hydrocephalus and number of surgeries) had more transient and acute effects, suggesting initial perioperative injury that tended to stabilize or improve over time, while other factors (e.g., young age at the time of treatment) had more stable long-term adverse effects. These findings could assist with identification of children at greatest risk, and suggest greater vulnerability of visual-auditory learning which may relate to white matter changes historically associated with irradiation treatment. Correspondence: *Marcos Di Pinto, Ph.D., Division of Behavioral Medicine, St. Jude Children's Research Hospital, 332 N. Lauderdale St., Mail Stop 740, Memphis, TN 38105-2794. E-mail: marcosdipinto12@gmail.com*

### Stroke/Aneurysm

#### J. BANOS & M. GUERDAT. Predictors of Orientation Log and Cognitive Log Performance in Stroke Patients.

**Objective:** The Orientation Log (O-Log) and Cognitive Log (Cog-Log) are brief bedside measures of orientation and cognition. They have proven useful for tracking mental status improvements in postacute TBI patients. They are used less widely in stroke, and variables that influence performance in this population have not been identified. This study sought to identify variables which influence O-Log and Cog-Log scores of stroke patients undergoing inpatient rehabilitation.

**Participants and Methods:** O-Log scores, Cog-Log scores, and other clinical data were collected from 140 stroke patients undergoing inpatient rehabilitation (ages 19 to 96 years,  $M=62.2$ ,  $SD=14.6$ ) in the course of bedside neurobehavioral examinations. Hierarchical multiple regression was used to examine the influence of demographic factors, previous neurologic history, and stroke characteristics.

**Results:** O-Log analysis proved challenging due to ceiling effects and skew beyond what is typically seen in TBI. No predictors were identified for the combined sample. In secondary analyses by stroke lateralization, time since stroke emerged as a predictor for left but not right hemisphere stroke. Several demographic variables (age, education, race) predicted Cog-Log performance, as did O-Log score. Secondary analyses by lateralization yielded comparable results.

**Conclusions:** O-Log scores were less variable in stroke than what is seen in TBI, consistent with the clinical course of each. Few predictors of O-Log performance were identified, possibly due to skew and lack of variability. The strongest predictor of Cog-Log performance was O-Log score, likely because it serves as a proxy measure of overall stroke severity. Demographic variables emerged as modest Cog-Log predictors. Correspondence: *James Banos, PhD, Physical Medicine & Rehab, Univ of Alabama at Birmingham, SRC 530, 1717 6th Ave South, Birmingham, AL 35233. E-mail: banos@uab.edu*

**J.S. BLOOM, R. THOMPSON, S. BONGIOLATTI, J. KNIGHT, S. MASON, T. FLYNN, S. SMITH, D. LICHT, L.A. BESLOW & R. ICHORD. Caregiver Perceptions of Traumatic Stress Symptoms in Children and Families Following Pediatric Stroke: A Pilot Study.**

**Objective:** Emotional reactions to a child's severe illness can include the development of acute and/or persistent traumatic stress symptoms in the ill child and in the child's family members. The purpose of this study was to identify the prevalence of traumatic stress symptomatology, including re-experiencing, avoidance, and hyperarousal, among a sample of children who have had a stroke and their primary caregivers.

**Participants and Methods:** A convenience sample of families enrolled in the Pediatric Stroke Registry at The Children's Hospital of Philadelphia were asked to participate in a structured telephone survey examining parent/guardian report of stroke outcomes ( $N = 27$ ). Subjects were currently age six or older, living, and had a history of ischemic or hemorrhagic stroke.

**Results:** Results were analyzed descriptively. Parents/guardians reported symptoms of re-experiencing (78%), avoidance (44%), and hyperarousal (82%), as well as functional impairment as a result of those symptoms (40%) as occurring "sometimes" or "often" in their children following stroke. Caregivers self-reported symptoms of re-experiencing (60%), avoidance (36%), and hyperarousal (48%), as well as functional impairment as a result of those symptoms (28%), as occurring "sometimes" or "often."

**Conclusions:** Results suggest that parents and guardians report the common occurrence of traumatic stress symptomatology in children with a history of stroke and, to a lesser degree, in themselves. Further exploration is necessary in order to more fully characterize the prevalence of traumatic stress symptomatology and its effects in this population.

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**A.N. CERNICH, M. DUX, R.L. KANE, G. WITTENBERG & R. MACKO. Feasibility of Computerized Neuropsychological Assessment for Cognitive Screening in the Chronic Stroke Population.**

**Objective:** Individuals with stroke experience a range of cognitive and motor impairments following injury, some receiving diagnoses of dementia or vascular cognitive impairment, no dementia (Desmond et al., 2002; Nyehnuis et al., 2004). The current study had as its aim the initial validation of a computerized cognitive measure for feasibility for repeat assessment in an ongoing clinical trial of exercise interventions in the chronic stroke population.

**Participants and Methods:** Participants who were at least 1 year post-stroke and suffered chronic hemiparesis were recruited from the Maryland Exercise and Robotics Center of Excellence studies ( $N=20$ , 65% male, mean age=51, 55% African-American). Location of stroke varied. No participant met criteria for depression or substance-related disorders. All participants received a battery of traditional and computerized neuropsychological measures that included ANAM and the Repeatable Battery for the Assessment of Neuropsychological Status. ANAM scores were consolidated into an Index of Cognitive Efficiency (ICE) that equally weights throughput scores across the measures used for combination into a single index. Spearman rho correlations between ANAM and the RBANS Index measures were performed to determine the validity of the ANAM Stroke Battery for use in this population.

**Results:** The correlation between the RBANS Total Index Score and the ANAM ICE score were significant and relatively strong in this small sample ( $\rho = .857$ ;  $p < .001$ ).

**Conclusions:** ANAM correlated well with a widely used screening measure used in the stroke population. The potential advantage of ANAM for monitoring of cognition in clinical trials such as this is the large number of alternate forms.

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**C.C. EVANS, C.D. VICKERY & A. SEPEHRI. Comparison of the FIM-Cognitive subscale and RBANS in an Acute Stroke Rehabilitation Sample.**

**Objective:** Previous studies have found that the FIM Cognitive subscale (FIM-COG) is predictive of outcome in the acute rehabilitation setting, but the association of this scale and neuropsychological functioning is equivocal. The present study examined the relationship between the FIM-COG and neuropsychological functioning at discharge from acute stroke rehabilitation.

**Participants and Methods:** Participants and Methods: Seventy-two inpatients derived from a consecutive sample received FIM-COG ratings at discharge and the RBANS.

**Results:** Results: Convergent validity was demonstrated through significant correlations between FIM-COG at discharge total and the five RBANS indices ( $r$ s ranging from .59 to .65) and significant differences on the RBANS Immediate and Delayed Memory and Language indices between individuals rated as moderate independent or higher and those rated in the dependent category on the corresponding FIM-COG items (Expression and Memory). However, a lack of concordance, possibly due to a ceiling effect of the FIM-COG, was noted; of the 37% of inpatients who were rated as moderate independent or above on FIM-COG items at discharge, 55% had impaired scores on at least 1 RBANS index. In predicting functional outcome at discharge (FIM Motor subscale), discharge FIM-COG accounted for 7% of the variance in a regression analysis. However, when the five RBANS indices were added to this model, FIM-COG dropped out as a significant predictor of discharge FIM Motor scores while the RBANS Visuoconstruction index emerged as the sole significant predictor, accounting for approximately 20.6% of the variance.

**Conclusions:** Conclusions: Results highlight limitations of the FIM-COG subscale, including ceiling effects and the lack of visual-construction items.

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**M.T. BARISA, C.A. NOGGLE & J.C. THOMPSON. Links Between RBANS Indices and ILS Performance Following Cerebrovascular Events.**

**Objective:** The current investigated the extent to which outcomes on the ILS appear related to and/or dependent upon performance measured by RBANS indices in a sample of post-cerebral infarction patients.

**Participants and Methods:** Participants included 47 patients, post-cerebral infarction, diagnosed via neuroimaging, who were administered both ILS and RBANS as part of a comprehensive neuropsychological evaluation. RBANS indices scores and ILS outcome scores were analyzed. **Results:** Immediate Memory indices on the RBANS demonstrated significant relationships with money management ( $r=.589$ ), managing home and transportation ( $r=.493$ ), and health and safety ( $r=.549$ ). Visual-spatial/Construction was also significantly related to money management ( $r=.556$ ), managing home and transportation ( $r=.503$ ), and health and safety ( $r=.429$ ). Language was significantly related to outcomes on money management ( $r=.594$ ), managing home and transportation ( $r=.642$ ), and health and safety ( $r=.689$ ). Attention was significantly related to money management ( $r=.598$ ), managing home and transportation ( $r=.593$ ), and health and safety ( $r=.648$ ). Finally, Delayed memory was significantly related to money management ( $r=.594$ ), managing home and transportation ( $r=.465$ ), and health and safety ( $r=.503$ ). In addition, to the focused indices, the Total Scales indices demonstrated the greatest relationship with ILS performance by producing significant correlations with money management ( $r=.762$ ), managing home and transportation ( $r=.675$ ), and health and safety ( $r=.709$ ). **Conclusions:** Establishment of ties between performance on RBANS indices and ILS outcomes may provide guidance for practitioners who are faced with the determination of a patient's capacity following cerebral infarction for independent living, yet do not have measures such as the ILS available. Additional implications and findings will be offered. Correspondence: *Chad A. Noggle, Ph.D., Psychology, Middle Tennessee State University, 261 Barfield Crescent Rd., Apt 2S06, Murfreesboro, TN 37128. E-mail: cnoggle@mtsu.edu*

**M.T. BARISA, C.A. NOGGLE & J.C. THOMPSON. Converging and Diverging Correlational Patterns of the RBANS Indices and ILS Based on Hemispheric Origin of Cerebrovascular Accidents.**

**Objective:** The current study investigated the degree of relationship between ILS outcomes and RBANS indices based on whether and individual has suffered a right or left cerebral infarction.

**Participants and Methods:** Participants included 23 patients post right-cerebral infarction and 24 post left cerebral infarction, diagnosed via neuroimaging, who were administered both ILS and RBANS. RBANS indices scores and ILS outcome scores were analyzed.

**Results:** Significant relationships were found between a majority of RBANS indices and ILS renderings for both right and left CVAs; however, discrepancies were noted between groups. For example, the relationships between Money management, Managing Home and Transportation, and Health and Safety with Immediate Memory, Attention, Delayed Memory and the Total score indices were significantly stronger ( $p<.001$ ) for those presenting with right-hemispheric infarction as compared to left. In fact, the relationships between Immediate Memory and both Managing Home and Transportation as well as Health and Safety were not even significant on an individual correlation basis for those with left hemisphere infarction. Similarly, the relationships between Managing Money and Attention; and Delayed Memory and Managing Home and Transportation as well as Health and Safety were also not significant following left hemispheric infarction. Performance on Language and Visual-spatial/Construction indices were significantly related to all three ILS domains equally for both right and left infarctions.

**Conclusions:** Findings may suggest a degree of reliability of making predictions of ILS outcomes based on only RBANS results for those with right hemispheric infarctions, but the same degree of reliability could not be established in left-hemispheric infarction.

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**L. SCHWARZ, J. FESTA, F. CHARBEL, S. AMIN-HANJANI & N. PLISKIN. Examination of Cognitive Functioning in North American Adults with Moyamoya Disease Utilizing the RBANS.**

**Objective:** Moyamoya (MMD) is a rare cerebral vasculopathy affecting the Circle of Willis. On angiographic imaging, the distal in-

ternal and proximal middle cerebral arteries are narrowed or occluded resulting in a compensatory vascular network that appears as "a puff of smoke". There is a bimodal peak of initial clinical presentation in the 1st and 4th decades of life but incidence of MMD in North American is unknown. There is limited information on the cognitive sequelae of MMD. The current study aimed to describe the specific pattern of deficits associated with MMD using a screening measure.

**Participants and Methods:** The files of 10 pre- and 4 post-operative patients with angiographically verified MMD were examined. Neurocognitive assessment included the Wechsler Test of Adult Reading (WTAR) and the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS).

**Results:** The combined sample mean estimated premorbid intelligence was within the average range (mean  $SS=92.75$ ,  $SD=16.45$ ). Pre-operative patients demonstrated a mean Total RBANS score within the impaired range (mean  $SS=74$ ,  $SD=7.73$ ). Furthermore, mean performance on measures of speed of processing (pre-op mean  $Z=-2.25$ ,  $SD=0.91$ ; post-op mean  $Z=-1.93$ ,  $SD=2.33$ ) and visuoconstruction (pre-op mean  $Z=-3.23$ ,  $SD=1.87$ ; post-op mean  $Z=-3.29$ ,  $SD=2.44$ ) were impaired for both groups.

**Conclusions:** Pre- and post-surgical patients with MMD demonstrate neurocognitive deficits with most pronounced impairments in processing speed and visuoconstruction. On clinical presentation to neuropsychologists, patients with MMD exhibit a similar pattern of cognitive impairment to that seen in other types of cerebrovascular disease.

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**R. THOMPSON, S.R. BONGIOLATTI, J. SANCHEZ BLOOM, J. KNIGHT, S. MASON, T. FLYNN, S. SMITH, D.J. LICHT, L.A. BESLOW & R. ICHORD. Parental Perceptions of Cognitive Changes and Academic Outcomes Following Pediatric Stroke.**

**Objective:** Children surviving stroke often have cognitive deficits that lead to school difficulties. The present study aims to 1) compare parents' perception of pre-post stroke cognitive abilities; 2) examine the relationship between parents' perceptions of post-stroke cognitive and academic abilities; and 3) explore parent perceptions of the effects of stroke in their children.

**Participants and Methods:** A convenient sample of families enrolled in the Pediatric Stroke Registry at The Children's Hospital of Philadelphia were asked to participate in a structured telephone survey examining parent report of stroke outcomes ( $n = 27$ ). Subjects were currently age six or older, living, and had a history of ischemic or hemorrhagic stroke. Parent-report of cognitive abilities and academics before and after stroke were examined (frequency count, correlations, and paired t-tests).

**Results:** Parents reported a significant increase in post-stroke cognitive difficulties with memory and cognitive fatigue ( $p < 0.05$ ). Parental perceptions of post-stroke difficulty in language arts was significantly correlated ( $p < 0.01$ ) with many perceived changes in cognition, including mood, expressive language, organization, learning information, homework, and physical coordination. Difficulty in math was significantly correlated ( $p < 0.01$ ) with difficulties with memory, test performance, learning information, homework, and cognitive fatigue. Almost half (44%) of parents attributed post-stroke academic difficulties to be a significant change from their child's premorbid functioning. Among this sub-sample, stronger correlations between academic difficulties and cognitive changes were found.

**Conclusions:** Parents perceive a relationship between their child's stroke, cognitive functioning, and academic performance. Additional findings, implications, and limitations are discussed.

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### D.E. TRAHAN. Continuous Visual Memory Test: Performance in Patients with Anterior Communicating Artery Aneurysms.

**Objective:** Aneurysms and associated hemorrhaging of the anterior communicating artery (ACC) are associated with a high base rate of memory problems, especially difficulties learning and retaining new information. However, studies examining visual recognition memory in this group are few. This study examines performance on the CVMT, a measure of recognition memory for complex ambiguous designs, in patients with documented hemorrhages of the ACC.

**Participants and Methods:** Participants were 27 adults (10 male, 17 female) ranging in age from 24-72 ( $M = 57.32$ ,  $SD = 12.47$ ). Average education was 13.15 years ( $SD = 2.31$ ). All had histories of ACC aneurysms with associated hemorrhaging documented by MRI/MRA and other neurodiagnostic studies. None had histories of other known neurological problems. All were administered the CVMT as part of a comprehensive assessment. Testing was conducted a mean of 57 days after the initial event.

**Results:** CVMT Total and Delayed Scores were transformed into z-scores using age-based means and standard deviations (Trahan & Larrabee, 1988, 1997). A t-test determined if group scores differed significantly from a population with a hypothesized mean of zero. Results revealed significantly lower scores for the ACC group for both CVMT Total ( $t = -2.87$ ,  $p < .01$ ) and Delay ( $t = -2.59$ ,  $p < .01$ ). Examination of sensitivity revealed that for the Total Score, 22 of 27 (81%) scored below established cutoff scores, while 19 of 27 (70%) fell within the impaired range for the Delay Score.

**Conclusions:** This study demonstrated that patients with ACC aneurysms and associated hemorrhaging exhibit a high rate of impairment in visual recognition memory (70-81%). Results also support the clinical utility and sensitivity of the CVMT in detecting amnesic problems in this patient group.

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### C. VICKERY, C.C. EVANS & A. SEPEHRI. Admission Functional Status and Rate of Functional Change Do Not Predict Depressive Symptoms at Discharge from the Acute Stroke Rehabilitation Setting.

**Objective:** Research has long recognized an association between depression and functional status in the acute stroke rehabilitation setting. However, the mechanism of this connection remains unclear. The present study investigated how self-reported depressive symptoms, functional status at admission, and change in functional status predict depressive symptoms at discharge from inpatient stroke rehabilitation.

**Participants and Methods:** Ninety-eight consecutively-admitted participants received the Geriatric Depression Scale (GDS) and ratings on the Functional Independence Measure (FIM) at admission and discharge. Growth curves provided an intercept (functioning on admission) and a slope (rate of change from admission to discharge) for each participant on the FIM Motor scale. Admission GDS total score and the FIM intercept and slope were used to predict discharge GDS total score. All relevant interaction terms were included to explore potential moderating relationships between these variables.

**Results:** Admission GDS total score was the sole significant predictor of discharge GDS scores, with higher ratings of depressive symptoms at admission predictive of higher ratings at discharge. FIM intercept and slope did not significantly predict GDS scores at discharge, nor were any interaction terms significant.

**Conclusions:** These results suggest that neither functional status at admission nor rate of change in functioning are significantly related to depressive symptom ratings at discharge. The lack of significant interactions suggests that emotional and physical functioning at the beginning of and during rehabilitation do not share a moderating relationship to predict depressive symptoms at stroke rehabilitation discharge. The relationship between depression and functional status in this setting requires further elaboration.

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### J. WILLIAMSON, N.L. DAVID, G. LEWIS, G. STEBBINS, C. MURPHY, M. HANDLEMAN, E. HARDEN & P. CORELICK. Hemispheric white matter integrity predicts shift to peripheral regulation of the autonomic nervous system in a stroke population.

**Objective:** The present study explores the relationship between white matter integrity and regulation of the autonomic nervous system (ANS) in response to positional manipulation.

**Participants and Methods:** 15 patients completed MRI four years after ischemic stroke. Diffusion Tensor Imaging (DTI) scans were performed on a 1.5T GE MRI with LX upgrade using a diffusion weighted single-shot spin-echo echo-planar sequence with two diffusion weights:  $b = 0$  and  $b = 800$  s/mm<sup>2</sup>. DTI-fractional anisotropy (FA) was computed for whole brain, and left and right hemisphere regions. Blood pressure was continuously recorded using a finger cuff, from which high and low frequency power shifts were calculated (blood pressure variability, BPV). A tilt chair was used with sitting and supine angles of 90, 60, 30 degrees, and return administered in successive three minute blocks. Regression models were used to examine the relationship of the variables.

**Results:** Right and left hemisphere FA together account for 48% of BPV at the steepest tilt condition, with a laterality effect (right hemisphere FA,  $r = -.672$ ,  $p < .05$ ). Whole brain FA ( $r = .566$ ,  $p < .05$ ) accounts for 32 percent of the variance in BPV at recovery (tilt return to 90 degrees).

**Conclusions:** DTI-FA decrements predict greater BPV to stress (positional tilt). The effect is lateralized in the high frequency domain (beat to beat shifts), possibly reflecting an interaction of right hemisphere functional systems and nuclei regulating the heart. Decrements in brain control of the ANS may have consequences including cognitive, behavioral, and physical deterioration and may also influence the course of cerebrovascular disease.

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## Paper Session 5: HIV/AIDS

1:30–3:00 p.m.

### M.S. KIM, J. JANG, M.J. WRIGHT, S.A. CASTELLON, A.L. GOODING, M.N. LAM & C.H. HINKIN. Cognitive and Psychiatric Predictors of Medication Adherence: A Cluster Analytic Approach.

**Objective:** Medication adherence can be adversely affected by multiple factors including neurocognitive dysfunction, psychiatric disorder, and substance abuse. This study examined how these factors might independently, and in combination, affect medication adherence among a cohort of HIV+ participants.

**Participants and Methods:** Participants included 404 HIV+ adults (66% diagnosed with AIDS) with a mean age of 41.8 and a mean educational level of 13.1. The majority of participants were African-American (65.6%) and male (81.7%). Medication adherence was measured using an electronic monitoring device (MEMS caps). Participants were administered a battery of neuropsychological tests, a structured psychiatric interview, and drug/alcohol use measures. Participants were classified on three dimensions: cognitively normal vs. impaired (GDS score > 1.0), depressed (BDI-II > 14), and substance abuse (DSM-IV diagnosis of drug/alcohol abuse).

**Results:** Medication adherence rates significantly differed as a function of the number of clinical disorders diagnosed ( $F(3, 400) = 7.62$ ,  $p < .001$ ). Post-hoc analyses revealed an expected "dose effect" as participants classified as cognitively impaired, depressed, and substance abusing had the lowest adherence rates (56%), followed by those with any two diagnosable conditions (72%). The normal group (no diagnostic condition) did not statistically differ from participants with only one diagnosable disorder (80% vs. 77%). A K-Means cluster analysis was then conducted that yielded a 6 cluster solution. Cluster membership was differentially associated with a number of neurocognitive, adherence, and demographic variables.

**Conclusions:** While neurocognitive dysfunction, substance abuse, and depression are all individually associated with medication adherence difficulty, patients with multiple disorders are at disproportionate risk for adherence failure.

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**B.W. BECKER, S.E. PANOS, J. JANG, A.L. GOODING, S.A. CASTEL-  
LON, R.S. DURVASULA & C.H. HINKIN. Longitudinal Study of Neuro-  
cognitive Function and Medication Adherence in HIV-Positive  
Adults: Association with Apathy and Stimulant Use.**

**Objective:** Apathy, a common neuropsychiatric disturbance in HIV that can be reliably distinguished from depression, may be a marker of the direct neurophysiologic effects of HIV on frontostriatal circuits. These same circuits are involved in information processing speed and working memory and serve as an activation site for stimulants. Although stimulant use and neuropsychiatric disturbances have been independently associated with poor medication adherence, their combined effects on adherence and neurocognition have yet to be assessed.

**Participants and Methods:** Participants included 69 HIV-infected adults who underwent cognitive and psychiatric testing at study entry and then six months later. Medication adherence and stimulant use were assessed continuously using electronic monitoring devices and drug urinalysis screening. Participants were grouped based on stimulant use (Users vs Non-users) and presence of apathy (Apathy present vs. No apathy).

**Results:** A three-way (Stimulant use, Apathy, Time) mixed design ANCOVA with depression as a covariate revealed an interaction effect with stimulant users who endorsed apathy demonstrating significantly lower adherence rates than the other groups (37% adherent vs 70-81%, respectively). A three-way Stimulant X Apathy X Time interaction effect was found for information processing speed ( $p = .001$ ) and working memory ( $p = .02$ ) and were attributable to declines among stimulant users with apathy endorsement. Neuropsychological performance improved or remained stable in the other 3 groups.

**Conclusions:** The concurrent presence of apathy and stimulant use is a better predictor of medication adherence and neurocognitive decline than either disorder alone.

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**J. FOLEY, M. ETENHOFER, M. WRIGHT, I. SIDDIQI, K. MASON,  
H. MYERS, E. SINGER, S. CASTELLON & C. HINKIN. Effects of  
Cerebrovascular Risk versus Age upon Cognitive Functioning in  
HIV-1-Infected Patients.**

**Objective:** This study examined the additive effects of cerebrovascular risk factors, advancing age, and HIV-infection upon neurocognitive functioning. A secondary aim was to determine the impact of pharmacological control of cerebrovascular risk.

**Participants and Methods:** Participants included 98 HIV-seropositive adults (Age=44.2[7.6]; education=13.1[1.9]; AIDS=62.5%; Ln CD4 count=5.8[0.8], Ln viral load=8.1[2.4]). Participants were administered a comprehensive neuropsychological battery. Contributions of cerebrovascular risk, pharmacological control of risk, and age were examined using ANOVA and multiple regression.

**Results:** Older (>50 years) HIV+ performed worse than younger (< 39 years) HIV+ on processing speed ( $p<0.01$ ;  $\eta^2=0.10$ ), executive functioning ( $p<0.01$ ;  $\eta^2=0.07$ ), and learning/memory ( $p=0.04$ ;  $\eta^2=0.04$ ). Cerebrovascular risk was associated with slower processing speed ( $p=0.02$ ;  $\eta^2=0.06$ ). A hierarchical multiple regression analysis, conducted for the processing speed domain, indicated that only presence of cerebrovascular risks contributed significantly ( $b=-2.071$ ;  $p=0.04$ ) when controlling for age. There was no interaction effect. Follow up analyses indicated that pharmacologically controlled at-risk subjects performed

superior to uncontrolled at-risk subjects on processing speed ( $p=0.01$ ;  $\eta^2=0.27$ ) and learning/memory ( $p=0.04$ ;  $\eta^2=0.18$ ), with trend findings on executive functioning ( $p=0.09$ ;  $\eta^2=0.13$ ). We then compared uncontrolled at-risk participants and seropositive controls; results revealed superior performance among the controls on processing speed ( $p<0.001$ ;  $\eta^2=0.147$ ), learning/memory ( $p=0.008$ ;  $\eta^2=0.08$ ), and executive functioning ( $p=0.04$ ;  $\eta^2=0.05$ ).

**Conclusions:** Cerebrovascular risks appear to confer significant impact for HIV+ individuals, and this effect may be of greater consequence to processing speed reductions than advancing age. The impact of cerebrovascular risk upon cognitive functioning appears to be more pronounced and widespread in the absence of adequate pharmacological control.

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**C.A. BOUSMAN, M. CHERNER, J. ATKINSON, R.K. HEATON,  
I. GRANT & I.P. EVERALL. Catechol-O-Methyltransferase, Exec-  
utive Dysfunction, and Sexual Risk Behavior in the Context of HIV-  
Infection and Methamphetamine Dependence.**

**Objective:** Catechol-O-methyltransferase (COMT) metabolizes prefrontal cortex dopamine (DA), a neurotransmitter involved in executive behavior; the Val158Met genotype has been linked to executive dysfunction, which might increase risky sexual behaviors favoring HIV transmission. We examined the influence of COMT genotype and executive functioning on sexual risk behavior among participants with or without HIV infection and methamphetamine dependence (METH+); both, conditions linked to DA disturbance and risk behavior.

**Participants and Methods:** 208 men (51 = METH+/HIV+; 67 = HIV-only; 46 = METH-only; 44 = Control) received a self-administered sexual behavior questionnaire that asked about the percent time they used a condom, engaged in oral, vaginal, anal and/or intoxicated sex, as well as the number of different sexual partners in the past year. All subjects were hepatitis C negative. An executive deficit score was derived from the Wisconsin Card Sorting Test, Trail Making Test Part B, and Halstead Category Test. COMT Val158Met polymorphism was assayed from blood-derived DNA.

**Results:** Linear regressions revealed that executive dysfunction significantly influenced number of sexual partners and additionally uncovered a genotype X executive dysfunction interaction ( $p < .05$ ). Regressions stratified by COMT genotype revealed that the relationship between executive dysfunction and number of sexual partners was statistically significant ( $p < .001$ ) for carriers of the Met/Met but not the Val/Met or Val/Val genotype.

**Conclusions:** COMT genotypic differences may moderate the influence of executive functioning on sexual risk-taking, supporting a role of DA metabolism in these behaviors. In the context of HIV and methamphetamine dependence, dopaminergic overactivity in the prefrontal cortex conferred by the Met/Met genotype appears to result in a liability for executive functioning and potentially associated risky sexual behavior.

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**D.F. TATE, S. ZHANG, M. SAMPAT, J. CONLEY, K. KERTESZ, S. RAN-  
GARAJAN, T. RUSSELL, J. PRICE, D.H. LAIDLAW, L. TAYLOR, D. MC-  
CAFFREY, C. GUTTMANN, T. FLANIGAN & K. TASHIMA. Para-sagittal  
Corpus Callosum Fractional Anisotropy is Associated With Measures  
of Attention and Motor Function Among HIV Infected Patients.**

**Objective:** HIV-associated white matter injury is a contributing pathological factor underlying cognitive dysfunction commonly observed in HIV-infected cohorts. Diffusion tensor imaging (DTI) has been shown to be sensitive to white matter abnormalities and cognitive dysfunction in this population. In this study, we examined the associations between fractional anisotropy (FA) acquired in the mid-sagittal (MSFA) plane, para-sagittal FA (PSFA) acquired from tractography results, and a broad range of cognitive function among an HIV-infected sample.

**Participants and Methods:** DTI and cognitive testing results from 21 ethnically diverse HIV-infected patients (mean age=41.28 years; education=12.85 years; 52% African American, CD4 count=406.29; 47% with undetectable viral loads) were examined. For each participant, we segmented the mid-sagittal corpus callosum (CC) into five functional related areas and calculated the average FA within each region. Using the segmented areas as seed points, we then generated tractography maps of fiber projections through each CC area. From these tractography maps, we calculated the average FA along the length of the streamtubes for a measure of PSFA. We then examined the relationship between MSFA, PSFA, and a summary cognitive performance z-score for five cognitive domains (attention, executive, motor, language, and memory).

**Results:** Consistent significant associations were noted between PSFA, attention ( $p<0.007$ ), and motor ( $p<0.02$ ) domains regardless of region examined. Executive, language, and memory domains were unrelated to PSFA ( $p>0.10$ ). No significant associations between MSFA and cognition were noted ( $p>0.09$ ). Fisher exact z-test comparisons demonstrated a significant difference in the magnitude of associations between PSFA and MSFA ( $p<0.01$ ) for these two domains.

**Conclusions:** PSFA from tractography may provide more robust and reliable measures of tract integrity than MSFA. One explanation may be that PSFA captures additional spatial variability in cognitively relevant tract integrity.

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### Invited Plenary: Reading the Genome for Genes for Reading

Speaker: Elena Grigorenko

1:45–2:45 p.m.

#### E. GRIGORENKO. Reading the Genome for Genes for Reading.

In this presentation, Dr. Grigorenko will provide an overview of the behavior- and molecular-genetic studies of reading ability and disability that are carried out in her laboratory. After contextualizing this work in the field in general, she will exemplify her laboratory's work by summarizing the results from research that utilizes different genetically informative designs, ranging from family segregation studies, through whole-genome screens and candidate-gene analyses, to single-case investigations. Dr. Grigorenko will conclude with a set of comments on how these studies enrich psychological theories of reading.

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#### Session 6: Alzheimer's, Aging, and Apolipoprotein E

1:30–3:00 p.m.

C.E. GLEASON, N.M. DOWLING, W.L. WHARTON, J.S. ROWLEY, A. LA RUE, B.P. HERMANN, S. ASTHANA & M.A. SAGER. **Cognitive performance of hormone therapy users and nonusers at-risk for Alzheimer's disease.**

**Objective:** Previous reports suggest that only women without a genetic risk factor for Alzheimer's disease (AD), the APOE4 allele, benefit cognitively from menopausal hormone therapy (HT). We examined the influence of HT use and two risk factors for AD, APOE4 genotype and parental history (PH) of AD, on a 5-factor cognitive profile.

**Participants and Methods:** 531 postmenopausal women enrolled in the Wisconsin Registry for Alzheimer's Prevention (WRAP), reported their past or current use of HT. Cognitive performance of women who used or are using HT (N=335, mean age=54.8) was compared to women who never used HT (N=196, mean age=57.2) in relation to APOE4 and PH status. General linear models were used to compare groups defined by HT use by APOE4 status and then by PH with age, education, and depression score entered as covariates in each model.

**Results:** Comparisons of HT users and nonusers revealed that women without the APOE4 gene on HT outperformed women naive to HT on verbal and visuospatial abilities factors. Likewise, comparing women with and without PH of AD revealed again that women exposed to HT outperformed women naive to HT on verbal ability and visuospatial tests, regardless of PH status. In both comparisons, the two groups did not differ on memory, working memory and speed-flexibility factors.

**Conclusions:** Verbal and visuospatial task performance was significantly different between HT users and nonusers for the APOE4 negative women, such that HT users outperformed nonusers; PH on the other hand did not appear to influence cognitive response to HT.

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J.L. WOODARD, R.C. GREEN, S.M. JAZWINSKI, J. ARNOLD, P. MARTIN, L.S. MILLER, A. DAVEY, M. BURGESS & L.W. POON. **Apolipoprotein E ε4 Adversely Impacts Cognitive and Functional Status in Caucasian Centenarians but not in African American Centenarians.**

**Objective:** Although it is associated with greater risk of Alzheimer's disease (AD), several studies suggest that the apolipoprotein E (APOE) ε4 allele does not affect cognition in late life. We investigated whether functional and cognitive performance differs between APOE ε4 carriers and non-carriers in participants from the Georgia Centenarian Study.

**Participants and Methods:** Using a population-based sample, 244 centenarians or near-centenarians between 98 and 108.6 years of age (M-age=100.5 years, 21% African American; 85% female) were recruited. Participants completed the Mini-Mental State Examination, Severe Impairment Battery, Fuld Object Memory Evaluation (episodic memory and right-left discrimination), Behavioral Dyscontrol Scale (executive functioning), motor speed assessment, and Direct Assessment of Functional Status (ability to perform basic and instrumental daily living skills). APOE genotyping was performed from a serum sample.

**Results:** Allele frequencies for the ε2, ε3, and ε4 alleles were  $0.120\pm 0.017$ ,  $0.802\pm 0.040$ , and  $0.078\pm 0.027$  for Caucasians and  $0.154\pm 0.069$ ,  $0.683\pm 0.089$ , and  $0.163\pm 0.071$  for African Americans, respectively. More African Americans were ε4 carriers relative to Caucasians (30.8% vs. 14.6%, Fisher's Exact Test  $p=.013$ ). Only among Caucasians, ε4 carriers demonstrated significantly ( $p<.05$ ) lower performance than non-carriers on all measures; Cohen's d effect sizes ranged from .43 to .73. ε4 status did not differentiate cognitive or functional performance for African Americans ( $p's>.05$ ; d's: .11 to .39).

**Conclusions:** The APOE ε4 allele occurs with greater frequency among African American centenarians. Among Caucasian centenarians only, ε4 carriers performed more poorly on tests of cognitive and functional performance. At least among Caucasians, the deleterious impact of APOE appears to persist well beyond 80 years of age.

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N.M. WISDOM, J.L. CALLAHAN & K.A. HAWKINS. **The Effects of Apolipoprotein E on Nondemented Cognitive Functioning: A Meta-Analysis.**

**Objective:** Nearly twice as many participants are represented in the current literature than were available at the time of the last major meta-analytic neurocognitive examination of Apolipoprotein E (ApoE) ep-

silon allele combinations. The meta-analysis in the current study sought to specifically examine (1) small effects of ApoE zygosity on various cognitive domains and (2) possible moderating variables associated with ApoE allele combinations that may have been undiscoverable in previous examinations of smaller data sets.

**Participants and Methods:** A total of 77 studies, representing 40,942 cognitively healthy adults were identified for inclusion in the current meta-analysis (random effects design).

**Results:** Results confirmed previous meta-analytic findings that ApoE allele  $\epsilon 4$  ( $\epsilon 4$ ) negatively impacts global cognitive ability, episodic memory, and executive functioning. Additionally, the results revealed a small effect suggesting that ApoE allele  $\epsilon 4$  adversely impacts perceptual speed. In contrast to earlier studies, the results also indicate that increases in age result in significantly larger differences between ApoE  $\epsilon 4$  carriers and ApoE non- $\epsilon 4$  carriers on measures of episodic memory and global cognitive ability.

**Conclusions:** ApoE  $\epsilon 4$  exerts broad, but specific, adverse small effects on a range of neurocognitive functions in cognitively healthy adults.

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#### T.T. LINEWEAVER, M.W. BONDI & D.P. SALMON. Knowledge of Genetic Risk for Alzheimer's Disease Impacts Both Subjective and Objective Memory.

**Objective:** We explored how genetic risk for Alzheimer's disease (APOE genotype) and knowledge of this risk influence memory self-perceptions and memory abilities.

**Participants and Methods:** 144 non-demented (MMSE>27) adults (ages 52-89) completed two subjective memory measures, two objective memory tests (Logical Memory [LM] and Rey-Osterrieth Complex Figure), and a depressive affect questionnaire. Participants were divided into four groups based on their APOE genotype ( $\epsilon 4$  vs. non- $\epsilon 4$ ) and knowledge of their genetic risk (yes vs. no). The groups were statistically comparable in age, education, gender distribution, general cognitive functioning, and mood.

**Results:** Although main effects of APOE genotype on memory self-perceptions or memory scores were not demonstrated, genotype did interact with genetic knowledge to impact both. The APOE Genotype X APOE Knowledge interaction reached statistical significance for four of eight subjective memory subscales and for immediate and delayed recall on LM; it neared significance ( $p < .08$ ) for two additional self-perception subscales. Participants who knew they were negative for the  $\epsilon 4$  allele rated their memory more positively and remembered more than participants who did not know they were gene-negative. An opposite pattern emerged for gene-positive participants; those who knew they were at genetic risk rated their memory more negatively and performed more poorly on LM than those who did not know they were at risk.

**Conclusions:** Results suggest the need to consider whether individuals have knowledge of their genetic risk for dementia when diagnosing conditions like Mild Cognitive Impairment, as this knowledge may impact both subjective and objective memory.

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#### C.S. BLOSS, D.C. DELIS, D.P. SALMON & M.W. BONDI. Compromised Cognition in Children with Risk Factors for Alzheimer's Disease.

**Objective:** The  $\epsilon 4$  allele of the apolipoprotein E gene (APOE- $\epsilon 4$ ) and a family history (FH) of Alzheimer's disease (AD) are risk factors for the development of AD. While studies to identify a preclinical phase of AD have led to evidence of APOE- $\epsilon 4$ - and FH-related differences in brain and cognitive functioning in healthy adults, the relative influence of these factors in children is unknown. Thus, in the current study, we investigated possible associations between these factors and cognitive functioning in children.

**Participants and Methods:** Participants were school-aged children ( $n = 109$ ) who were administered verbal achievement tests, the Rey-Osterrieth Complex Figure Test (Copy Condition; RCFT-CC), assessment of family medical history, and buccal swab testing to determine their APOE genotype. Univariate ANOVA was employed to assess cognitive test score differences as a function of APOE- $\epsilon 4$  status and FH status.

**Results:** Twenty-two percent of children were APOE- $\epsilon 4$ -positive and 29.1% endorsed a FH of AD. Although there were no significant main effects of APOE- $\epsilon 4$  status or FH status, significant interaction effects were observed with respect to the Reading and Language achievement tests, as well as the RCFT-CC. That is, children who possess both risk factors obtained the lowest scores on these measures ( $p < 0.05$ ) relative to children in the other three groups.

**Conclusions:** Findings suggest a synergistic effect of these AD risk factors such that when both are present, cognition may be adversely impacted as early as childhood. Thus, risk factors for a disorder of pathological aging (i.e., AD) may have implications for the etiology of certain types of learning difficulties in children.

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### Paper Session 7: Alzheimer's Disease

3:00–4:30 p.m.

#### L.D. MEDINA, E. WOO, Y. RODRIGUEZ, J.L. CUMMINGS & J.M. RINGMAN. Metamemory in Familial Alzheimer's Disease Mutation Carriers.

**Objective:** To assess metamemory, knowledge of one's own memory functioning, in participants at risk for familial Alzheimer's Disease (FAD). The lack of insight into memory impairments is a common phenomenon in Alzheimer's dementia. Research on metamemory in persons at risk for autosomal dominant FAD mutations is needed as they provide the opportunity to study the earliest changes in Alzheimer's disease. When individuals with FAD mutations present with subjective memory complaints, determination of metamemory accuracy becomes crucial for characterizing the earliest deficits in insight.

**Participants and Methods:** 31 at-risk individuals for early-onset FAD, of which 19 were non-demented mutation carriers (MCs) and 12 were non-mutation carriers (NCs), assessed their memory abilities and use of mnemonics with the Memory Functioning Questionnaire (MFQ). Investigators were blind to participants' mutation status. Participants also completed verbal memory and executive function measures. Linear regression models were then used with MFQ subscales as predictor variables and objective cognitive scores as outcome variables.

**Results:** MC self-reports of greater memory functioning predicted poorer objective executive ( $p < 0.05$ ) and delayed memory ( $p < 0.02$ ) test scores. In contrast, self-reports of better memory functioning predicted better objective executive ( $p < 0.04$ ) and delayed memory ( $p < 0.05$ ) test performance in NCs. In both groups, greater self-reported use of mnemonics predicted better memory performance (MCs:  $p < 0.05$ ; NCs:  $p < 0.03$ ).

**Conclusions:** The data suggest a very early loss of insight in people with FAD mutations. Reported use of mnemonics, though, seems to be of benefit to cognitive functioning regardless of mutation status.

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#### M. MARQUINE, E.L. GLISKY, E. RECKNOR & S. RAPCSAK. Self and Other-Person Knowledge in Alzheimer's Disease and Mild Cognitive Impairment.

**Objective:** Individuals with Alzheimer's Disease (AD) are often described as "no longer being themselves". However, relatively little is known



about the extent to which personality trait knowledge is affected in AD or other memory disorders. Only one case study has been reported in the literature exploring such knowledge in an individual with AD. The aim of the present study was to explore the extent to which patients with mild cognitive impairment (MCI) and AD retain and/or update their self-knowledge.

**Participants and Methods:** Ten individuals with AD, 10 individuals with MCI, and 10 controls underwent neuropsychological evaluation. Additionally, participants and their informants completed personality trait questionnaires to assess consistency and “accuracy” of self- and other-person knowledge.

**Results:** Intraclass correlation coefficients between personality traits ratings were computed to assess self- and other-person knowledge. A between-subjects analysis of variance on these measures showed that AD patients were as consistent as MCI patients in rating themselves, but were less accurate than MCI patients and controls in doing so. In contrast, there were no group differences on other-person knowledge measures. Further, AD patients who showed inaccurate (but consistent) knowledge of self, tended to rate themselves as they used to be prior to disease onset. Results from a multiple linear regression analysis found frontal function to be the main predictor of accuracy of self-knowledge.

**Conclusions:** At least some AD patients, particularly those with compromised frontal functioning, may be unable to update their sense of self and may be operating based on knowledge of a former self.

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#### **D. MARSON, M. SHEROD, R. GRIFFITH, J. COPELAND, R. MARTIN & K. TRIEBEL. Neurocognitive Models of Financial Capacity Across the Dementia Spectrum: Normal Aging, MCI, and AD.**

**Objective:** Financial capacity is a complex independent activity of daily life (IADL) critical to independent functioning of older adults, and very sensitive to impairment in patients with amnesic mild cognitive impairment (MCI) and Alzheimer’s disease (AD). However, little is known about the neurocognitive basis of financial impairment in dementia.

**Participants and Methods:** We developed cognitive models of financial capacity in cognitively healthy older adults ( $n=85$ ) and patients with MCI ( $n=113$ ) and mild AD ( $n=43$ ). All participants were administered the Financial Capacity Instrument (FCI) and a neuropsychological test battery. Univariate and multiple regression procedures were used to develop cognitive models of overall FCI performance across groups.

**Results:** Three very similar models of overall financial capacity were identified across groups. The control model ( $R^2=.38$ ) comprised (in order of entry) written arithmetic skills, delayed story recall, and simple visuomotor sequencing. The MCI model ( $R^2=.69$ ) comprised written arithmetic skills, visuomotor sequencing and set alternation, and race. The AD model ( $R^2=.65$ ) comprised written arithmetic skills, simple visuomotor sequencing, and immediate story recall. As reflected above, written arithmetic skills (WRAT-3 Arithmetic) was the primary predictor across models, accounting for 27% (control model), 46% (mild AD model), and 55% (MCI model) of variance. Executive function and verbal memory were secondary model predictors.

**Conclusions:** The results offer insight into the cognitive basis of financial capacity across the dementia spectrum. Despite significant differences in the cognitive function and financial skills of controls, patients with MCI, and patients with AD, the same core cognitive functions mediated financial skill performance across the three groups. These core cognitive functions were (1) knowledge of numbers and arithmetic operations, and calculation ability; and (2) to a lesser extent, visual attention and sequencing, and auditory verbal recall.

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#### **E.B. TEAGUE & S. PALSSON. Early Neuropsychological Markers of Alzheimer’s Disease among Asymptomatic Siblings of Alzheimer’s Patients: A Longitudinal Study.**

**Objective:** The present study aimed at examining the cognitive profiles of asymptomatic first-degree relatives of patients with Alzheimer’s disease (AD) and at identifying early cognitive markers of AD.

**Participants and Methods:** The cognitive performances of 34 asymptomatic siblings of AD patients (68-88 years) were compared to those of 19 normal control subjects (69-81 years) matched to the siblings with regard to age, gender, and education. The two groups were tested twice with a test-retest interval of six years.

**Results:** In a mixed Analysis of Variance (ANOVA) the siblings showed impaired performance across the two testing situations on tests of verbal immediate and delayed recall, as well as constructional abilities. Although the siblings were impaired relative to the control group both at time 1 and 2, cognitive performance in the control group declined to a similar extent over the course of time. Correlational analyses revealed a stronger relationship between self-reported memory problems and memory performance among the siblings compared to the control group.

**Conclusions:** Because attrition was highest among siblings who already showed subtle cognitive deficits at time 1, the study was unable to adequately map the pattern of cognitive change in this group. However, the results suggest that asymptomatic siblings of AD patients show cognitive vulnerabilities in verbal memory and constructional abilities that might be a manifestation of preclinical AD. Further, the results indicate that siblings monitor changes in their memory more accurately than those who have no family history of AD, suggesting heightened sensitivity to cognitive changes associated with the disease.

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#### **G. POTTER, H. WAGNER & D.C. STEFFENS. Neuropsychological Prediction of Conversion to Alzheimer’s Disease in Late-Life Depression.**

**Objective:** Research suggests that some manifestations of late-life depression may be a prodrome to Alzheimer’s disease (AD). The current study explored the neuropsychological performance of individuals with late-life depression as a predictor of conversion to AD.

**Participants and Methods:** Participants ( $N = 138$ ) with depression received a neuropsychological examination at time of enrollment in a pharmacologic treatment study. Participants were then followed longitudinally and assessed at annual diagnostic conferences for clinical diagnoses of cognitive impairment based on DSM-IV and other recognized criteria. The neuropsychological predictor variable was the total score (TS) from the Consortium to Establish a Registry for Alzheimer’s Disease (CERAD) battery.

**Results:** Examining AD specifically, individuals with AD were older, had lower depression severity, and lower CERAD TS at baseline; however, there was no difference in number of apoE4 alleles between groups. Logistic regression models were used to estimate odds of AD diagnosis ( $n = 16$ ) relative to a diagnosis of normal cognition ( $n = 122$ ). CERAD TS performance at baseline enrollment was a significant predictor of AD diagnosis while controlling for age, education, and depression severity.

**Conclusions:** The current study found that a test battery sensitive to detection of AD was elevated among depressed individuals approximately 2-3 years prior to their clinical diagnosis for this condition, but conversion to AD was unrelated to depression severity and apoE4 genotype. Prodromal AD among depressed older adults may be detected with neuropsychological testing, which has important implications for depression treatment and intervention for cognitive deficits.

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**Symposium 5:  
Developmental Changes in the Sign and Spoken  
Communication of Young Cochlear Implant  
Recipients**

**Chair: Brenda Seal**

**3:15–4:45 p.m.**

**B.C. SEAL. Developmental Changes in the Sign and Spoken Communication of Young Cochlear Implant Recipients.**

**Symposium Description:** Controversy over the use of sign language in early intervention with deaf children who receive cochlear implants focuses largely on a “mismatch” theory in which signs, representing a visual language, compete with speech, an auditory language, increasing demands on young children’s working memory. This theory implies difficulty listening to and watching a speaker’s face while attending to the speaker’s signing, and difficulty learning to speak when signing. Signing children who acquire useful audition from cochlear implants offer never-before-possible opportunities to explore signing’s influence on speech development and audition’s influence on sign development. In this symposium, we begin with a summative literature review that supports superior outcomes in implanted children not exposed to signs, and follow up with three presentations on implanted children’s bimodal acquisition of sign and speech: (1) a report of longitudinal changes in signs and consonants converted into standard scores for comparisons across children from diverse backgrounds; (2) descriptive analysis of sign and speech acquisition trajectories and correlations across ages; (3) and Auditory Neuropathy/Dys-synchrony outcomes in an implanted twin’s communication development with comparisons to his hearing monozygotic sibling’s outcomes before, during and after sign language intervention. Evidence from these presentations challenges notions of competitive processing for manual and oral communication and suggests, instead, a mutually supportive bimodal networking. The consistent patterns of the children’s acquisition rates suggest that this bimodal relationship is predictable in the early months post-implant and may only be fully realized in the presence of a useful auditory system.

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**K.A. BELZNER. Longitudinal Outcomes in a Diverse Sample of Deaf Children with Cochlear Implants.**

**Objective:** We questioned whether the use of sign language would be harmful to the acquisition of spoken language in young deaf children who undergo cochlear implant surgery, particularly in children from different demographic backgrounds.

**Participants and Methods:** Twenty-two signing children with diverse socioeconomic, racial-ethnic backgrounds and with a variety of secondary disabilities, were tracked up to 3 years post-implant. Data collection focused on changes in consonants, important to speech intelligibility, and changes in sign locations, configurations, and movements, important to sign intelligibility. New consonants, sign locations, movements and handshapes were tallied over multiple sessions and converted to z scores for each child. Plots of z scores across sessions enabled calculations of slope and, when plotted against a log scale, reflected the children’s rate of acquisition. Z scores were compared across all children and for three demographic divisions; pair-wise comparisons were run to determine any significant differences in acquisition rates between groups.

**Results:** Results showed new consonants and sign phonemes to emerge at similar rates of acquisition across the entire group and across children from different minority, racial-ethnic and additional disability backgrounds. Regression slopes revealed an initial burst in both speech and sign phonemes in early months post-implant with continuous but plateauing growth over time.

**Conclusions:** We found no evidence that signing was harmful to the children’s speech acquisition. Instead, the parallel development of consonant and sign phoneme growth was robust across all children, including those who have not previously been represented in outcomes research because of their minority, poverty, or additional disability status.

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**B.C. SEAL. Speech and Sign Acquisition Trajectories and Correlations Across Three Age Groups.**

**Objective:** We questioned whether the acquisition trajectories of speech and sign phonemes would follow developmental norms in deaf children following cochlear implantation.

**Participants and Methods:** Videotaped samples of 22 deaf children were analyzed every 3 to 6 months for up to 3 years post-implant. Consonant and sign inventories were determined from the first sample and newly emerging consonant and sign phonemes were plotted over progressive sessions and compared against expected stages of development. Progressive sums of consonants, sign locations, movements and handshapes were correlated over time for those implanted between 12 and 36 months, 37 and 60 months, and 61 and 83 months of age.

**Results:** New consonants and new sign phonemes emerged in expected developmental sequences and were significantly correlated across three age groups. The 10 younger implanted children showed moderately strong correlation coefficients ranging from 0.53 for consonants and sign movements to 0.63 for consonants and sign handshapes. R values for the 8 children in the middle age group were more moderate at 0.47 between new consonants and new sign handshapes. The 4 oldest children who had signed longer than the others showed strong correlation coefficients, from 0.76 for consonants and handshapes to 0.86 for consonants and movements.

**Conclusions:** The developmental acquisition of speech and sign phonemes and the strength of the relationships in their emergence over time and across age groups suggest an important neuromotor link between emergence of consonants that differ by movement within the oral cavity and signs that differ by movement and handshape within the hands.

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**B.L. STOGNER. Communication Development Before, During, and After Sign Language Intervention with an Auditory Neuropathy/Dys-synchrony (AN/AD) Case and his Typically-Developing Monozygotic Twin.**

**Objective:** We report on the influence of sign language in the spoken language development of a monozygotic twin diagnosed with Auditory Neuropathy/Auditory Dys-Synchrony (AN/AD).

**Participants and Methods:** Monozygotic male twins experienced different diagnoses of hearing loss and AN/AD following a full-term delivery with significant histories of hyperbilirubinism. One twin’s audiological testing revealed hearing loss with AN/AD; the other twin tested normally. Sign language was offered by the parents to both babies and developmental measures showed both boys to reach similar milestones in all areas except use of audition at 7, 9 and 12 months of age. The AN/AD twin underwent cochlear implant surgery at 14 months; sign language was continued with both boys until 21 months when communication gains on the Communication Development Inventory (CDI) and Infant-Toddler Meaningful Auditory Integration Scale (IT-MAIS) showed the implanted twin’s communication development had reached the level of his brother. Sign language was subsequently eliminated until a 12-week follow-up evaluation showed the implanted twin to have fallen behind his brother in quantity of speech output, vocabulary and syntactic development. Sign language was reinstated for the implanted child with more intensive intervention at home and in his clinical sessions.

**Results:** Test scores across the twins' 2-and-a-half years offered support for sign language for both twins during the first year of their communication development, and for the implanted twin beyond the onset of first words.

**Conclusions:** Sign language benefits may extend beyond the acquisition of first words in implanted children diagnosed with AN/AD.

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## Symposium 6: Translational Science: Using the Shape School to Probe Ontogeny, Development, and its Deviations

Chair: Kimberly Espy

3:15–4:45 p.m.

**K.A. ESPY. Translational Science: Using the Shape School to probe ontogeny, development, and its deviations.**

**Symposium Description:** Using a single instrument, the Shape School, the presentations are organized to illustrate the benefits of translational science. First, Espy et al. describe the longitudinal development of executive processes by contrasting growth rates among condition by age. Washburn and colleagues probe the ontogeny of executive skill development using primates who vary in language skill. Gerard-Morris present new findings on longitudinal outcome of executive skills in children who sustained traumatic brain injury very early in life. Woodward et al. demonstrate the impact of very preterm birth on executive processes using the Shape School. Finally, Shoemaker and colleagues demonstrate that children with differing psychiatric symptoms differ in their executive profile. Findings are discussed in light of developmental parallels and discrepancies in this critical period neural change.

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**K.A. ESPY, S. WIEBE & T. SHEFFIELD. Developmental Trajectories of Executive Processing on the Shape School.**

**Objective:** Although there is an emergent literature on executive control in preschool, studies to date use cross-sectional designs and do not elucidate patterns of skill growth. The purpose is to characterize developmental trajectories of executive control using the Shape School.

**Participants and Methods:** A sample of 319 typically-developing preschool children (155 girls, 164 boys) completed up to 3 assessments (n=226 tested at age 3.0, 3.75, and 4.5 years; n=47 at 3.75 and 4.5; n=46 at 4.5 years) in a cross-sequential cohort design. Children completed the computerized version of the Shape School, where subjects named stimuli according to inhibit and switch rules that varied across conditions. Proportion correct and mean response time were scored for each condition.

**Results:** Using SAS Proc Mixed, there was substantial growth in accuracy across age. There was a decreasing decrement in accuracy on naming shape compared to color. Linear slope was largest for the Inhibit condition. Girls showed more rapid growth in accuracy on the Switch condition relative to boys, and both named more stimuli correct on the Mixed relative to Switch conditions. In contrast, the decrement in latency on naming shape relative to color decreased with age only in boys. Developmental trajectories in latency changes in the Inhibit and Switch conditions were parallel with the Control, and were more flat on the Mixed condition.

**Conclusions:** The Shape School revealed different developmental trajectories of executive process growth across the early preschool period through contrasting conditions and comparing accuracy and latency, which serve as a baseline by which to understand developmental deviations.

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**D. WASHBURN. Simians Attend the Shape School.**

**Objective:** Monkeys attend. That is, they select some rather than other competing stimuli to which to respond, and do so with variations in intensity and temporal variability similar to what is observed for human adults and children. Additionally, nonhuman primates appear to be sensitive to the same classes of attention-control constraints as humans, with selection determined by the combination of stimulus capture, stimulus control, and executive control. However, there are pronounced species differences in the relative potency of these determinants of attention, and the Shape School provides a platform that highlights monkeys' decreased capacity for executive attention, particularly in the face of stimuli that are strongly primed or otherwise associated with a response.

**Participants and Methods:** Rhesus monkeys manipulated a joystick so as to respond to computer-graphic stimuli in a version of the Shape School. Within the task, we attempted to bias attention by manipulating variables known to affect executive constraints (e.g., incentives, which alter the intentional control of attention), experiential constraints (e.g., the local probability of a particular response, such that some responses were habitual or highly primed), and environmental constraints (e.g., unexpected changes in the appearance of the stimuli so as to elicit attention capture).

**Results:** The effects of these manipulations on Shape School performance will be presented.

**Conclusions:** The cross-species ontogeny of executive processes reveal important similarities and differences.

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**K. SCHOEMAKER, K.A. ESPY, S. WIEBE, T. BUNTE, M. DEKOVIC & W. MATTHYS. Shape School task in preschool children with behavior problems.**

**Objective:** Relatively little is known about the role of executive functions (EF) in behavior disorders in preschoolers. In the present study we assessed EF in preschoolers with Attention Deficit Hyperactivity Disorder (ADHD), Disruptive Behavior Disorder (DBD), a combination of both disorders and normally developing children. The goal was to investigate performance on the Shape School task in preschoolers with different types of behavior problems and in normally developing children.

**Participants and Methods:** Presently the sample consists of 82 children between the age of 42 and 65 months (M = 55, SD = 8); almost equally distributed among the four groups. EF was measured using Shape School (SS, Espy 1997); next to the two control conditions the task consists of the inhibit, switch and inhibit-switch condition. Besides psychiatric diagnoses, the Child Behavior Checklist (CBCL) scores on the attention problem and aggressive behavior scale were used.

**Results:** Children with both DBD and ADHD performed significantly worse than the normal control group on the switch and inhibit-switch condition. The correlation between SS inhibit and CBCL attention problems was  $-.34$  ( $p < .01$ ) and between SS inhibit and aggressive behavior  $-.23$  ( $p < .05$ ). The correlation between SS switch and attention problems was  $-.43$  ( $p < .001$ ) and between SS switch and aggression  $-.29$  ( $p < .05$ ). The correlation between SS inhibit-switch and attention problems was  $-.33$  ( $p < .05$ ) and between SS inhibit-switch and aggression  $-.16$  (ns).

**Conclusions:** Children with co-morbid disorders performed worse than normal control children. Attention problems in preschoolers are associated with inhibition and flexibility

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**V. PRITCHARD, K. HOOD, P. ANDERSON & L. WOODWARD. Cerebral abnormalities on neonatal MR and later inhibitory and switching abilities in preschool children born very preterm.**

**Objective:** Very preterm (VPT) children are at elevated risk of executive dysfunction by middle childhood. However, less is known about the emergence of specific executive difficulties during the preschool years or their neonatal neurological correlates. Objectives were:

1) To compare the inhibitory control and switching abilities of VPT and full term (FT) children at age 4 years; and 2) to examine associations between neonatal MRI measures of cerebral white matter abnormalities (WMA) and total tissue volumes and the development of these executive skills.

**Participants and Methods:** A regional cohort of 106 VPT ( $\leq 33$  weeks gestation) and 106 FT children studied from birth to age 4. At term equivalent, VPT children underwent a structural MRI scan. These scans were analysed qualitatively for the presence and severity of cerebral WMA and quantitatively for tissue volumes. At age 4 years (corrected), all children were assessed using the Shape School task, a measure of inhibition and cognitive flexibility.

**Results:** Across all task conditions (inhibit, switch, mixed), VPT children were less likely to complete task conditions ( $p < .03$ ). However, even amongst those children able to complete, group differences were most marked for the inhibitory condition ( $p < .01$ ). Both VPT and FT groups, however, performed similarly on the task switching condition ( $p = .62$ ). Impaired performance was significantly predicted by the severity of WMA ( $p < .02$ ) but not total tissue volume on neonatal MRI.

**Conclusions:** Early difficulties in inhibitory abilities are evident amongst VPT children by age 4. The presence of WMA on term MRI was more prognostic than measures of cerebral tissue volumes.

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**A. GERRARD-MORRIS, G. TAYLOR, K. YEATES, N. WALZ, T. STANCIN & S. WADE. Effects of Early Childhood Traumatic Brain Injury (TBI) on Development of Executive Functions as Measured by the Shape School.**

**Objective:** To investigate the effects TBI in early childhood on development of executive functions (EF).

**Participants and Methods:** Children with severe, moderate, and mild TBI ( $n$ 's = 23, 64, 15), along with an orthopedic injury (OI) comparison group ( $n = 119$ ), were recruited from admissions to four hospitals in Ohio. The children were 3-6 years at injury and were seen at a baseline evaluation and at 6-, 12-, and 18-month follow-ups. The Shape School was administered to assess EF. By requiring the child to use different rules for naming a series of cartoon-like faces, this test assesses simple naming, response inhibition (e.g., not naming "sad" faces), set switching (e.g., naming color of some of faces but the shape of others), and combined inhibition/set switching. Mixed model analysis was used to examine group differences in raw score changes across time. Age at injury, SES, sex, and race were covariates.

**Results:** Relative to the OI group, the severe TBI had constant deficits over time on all measures. The severe TBI group's deficits in set switching and inhibition/set switching remained significant even when controlling for simple naming or a measure of general ability (DAS GCA). The moderate TBI group also had deficits on some measures. Group differences did not vary with age at injury or SES.

**Conclusions:** TBI in young children results in specific deficits in EF as measured by the Shape School. Consistent with previous literature, follow-up reveals that these skills develop after injury but do not recover relative to age expectations.

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**Poster Session 5:  
Neurocognitive Functions**

**3:15–4:45 p.m.**

**Executive Functions/Frontal Lobes**

**E.S. AHMED, C. GODSEY, A. KASIAN, G. PATEL & L.S. MILLER. The Relationship Between Executive Function and Theory of Mind.**

**Objective:** This study conducted a comprehensive examination between Executive Function (EF) and Theory of Mind (ToM). Additionally, it studied whether each of the ToM tests utilized different cognitive domains which was supported in earlier research (Ahmed, Abner, & Miller, 2007).

**Participants and Methods:** 123 undergraduate students were administered the Delis-Kaplan Executive Function System (D-KEFS) along with three tests of ToM [Reading the Mind in the Eyes (RMET), Strange Stories (SS), and Faux Pas tests (FP)].

**Results:** Due to lack of correlation among ToM tests, three multiple regression analyses were conducted using D-KEFS variables as predictors and ToM performance as outcomes. Different EF patterns accounted for significant variance in each ToM test. Overall, cognitive flexibility, verbal fluency, design fluency, and problem solving were significant predictors of ToM. For RMET, cognitive flexibility and problem solving had an unexpected inverse relationship while deductive reasoning related to ToM in the expected direction. For SS, verbal fluency, design fluency, and deductive reasoning were significant predictors. Finally, FP performance was related to problem-solving.

**Conclusions:** In addition to a lack of correlation among each ToM test, this study found different patterns of EF accounted for significant variance among each. This suggests that while each of the tests has been known to measure ToM, they each utilize different cognitive processes. Additionally, the inverse relationship in RMET suggests that it may not necessitate intact EF skills to recognize emotion. In sum, this study supported an EF-ToM relationship and supported previous research that the three ToM tests measure different cognitive domains.

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**G. ARAUJO, C. COLEMAN, D.K. GRANGE, R.D. STEINER, R.C. MCKINSTRY & D.A. WHITE. Response Monitoring in Children with Phenylketonuria.**

**Objective:** Children with phenylketonuria (PKU) exhibit subtle impairments in executive abilities. We examined a specific aspect of executive ability, response monitoring, by analyzing variability in speed of responding during performance of a go/no-go task.

**Participants and Methods:** Data from 92 children (37 children with PKU, 55 control children) from 7-18 years of age were analyzed. In the go-condition, children were to press a key as quickly as possible following presentation of three specified shapes. In the no-go-condition, children were to inhibit key presses in response to a fourth specified shape; no-go trials occurred on one of every four sequential trials.

**Results:** Children with PKU had a significantly larger standard deviation (SD) in reaction time (RT) on both correct go-trials (PKU = 178.65, Control = 140.23;  $p < .01$ ) and on trials immediately following errors (PKU = 217.13, Control = 156.75,  $p < .05$ ), indicating more variable responding on all trials for children with PKU relative to controls. Additionally, a coefficient of variability (CV) was calculated for correct go-trials for each subject using the formula  $CV = (SD/MeanRT) * 100$ . Children with PKU had a significantly larger CV than controls (PKU = .27, Control = .24,  $p < .05$ ), indicating more variable responding on correct go-trials among children with PKU independent of any differences in mean RT.

**Conclusions:** Findings from our study indicate that children with PKU are more variable in speeded responses than controls. These findings extend previous findings of response monitoring deficits in children with PKU.

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**A. ARENTOFT, V. SWEAT, H. BRUEHL & A. CONVIT. The Influence of Exercise and Eating Habits on Cognitive Performance in Obese and Non-Obese Adolescents.**

**Objective:** This study compares cognition in obese and non-obese adolescents, and explores the role of lifestyle/social factors in cognitive performance.

**Participants and Methods:** Twenty-one normal weight and overweight adolescents were matched with 21 obese (BMI  $\geq$  30.00) adolescents on age, education, IQ, and socioeconomic status. Participants received medical, neurological, psychiatric, and neuropsychological evaluations. Plasma glucose and insulin levels were assessed.

**Results:** Adolescents did not differ in cognitive performance (e.g. memory, attention, executive function, verbal fluency, and motor), although higher BMI was associated with decreased processing speed. Obese adolescents reported lower mental health-related quality of life and less cognitive inhibition when eating. Univariate regressions indicated that fruit and vegetable intake and vigorous exercise were the most significant predictors of cognition among all participants. Regressions showed that both predictors accounted for a significant amount of variance in attention/working memory (22.60-28.51%,  $p=0.00-0.0$ ), executive functioning (25.85-28.73%,  $p=0.02-0.03$ ), processing speed (15.82-23.63%,  $p=0.02-0.06$ ) and verbal fluency (25.55%,  $p=0.01$ ). Results were relatively unchanged after accounting for BMI and HOMA (Homeostatic Assessment Model; estimates insulin sensitivity, which can be decreased in obesity and linked to cognition).

**Conclusions:** Social/lifestyle factors associated with obesity may affect cognition more than obesity itself. Poorer nutrition and less vigorous activity were associated with worse cognition, particularly attention/executive functioning. This may reflect slowed development of the frontal lobes, which are still developing during adolescence.

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**P. BANERJEE, D.K. GRANCE, R.D. STEINER, R.C. MCKINSTRY & D.A. WHITE. Strategic Processing in Children with Phenylketonuria.**

**Objective:** We examined strategic processing in children with phenylketonuria (PKU) by analyzing semantic and serial clustering during a word-list learning task.

**Participants and Methods:** One hundred children (45 PKU, 55 control) from 7 to 18 years of age recalled 18 words comprising 3 semantic categories across 5 trials. Number of words recalled, as well as number of words in serial and semantic clusters and number of serial and semantic clusters, were examined as a function of age.

**Results:** Regression showed that PKU and control groups recalled the same number of words as a function of age. However, a significant age X group interaction for number of serial clusters ( $F(1, 96) = 9.97, p < .01$ ) and words in serial clusters ( $F(1, 96) = 7.41, p < .01$ ) indicated dissimilar recall strategies for the groups as a function of age. Specifically, serial clustering by controls decreased with age, whereas serial clustering by children with PKU did not change with age. The groups did not differ significantly in number of semantic clusters or words in semantic clusters as a function of age.

**Conclusions:** Although children with PKU and controls recalled an equal number of words, the two groups used different strategic processing approaches with age. Serial clustering lessened in controls but

remained constant in children with PKU as a function of age. No differences were observed for semantic clustering; however, it is possible that children with PKU were slower and less efficient than controls in semantic processing, an issue that needs to be explored through further study using a timed recall task.

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**F.F. BARBOZA, T. SOLEDADE, R. ALVES, V. LEITE, K. PARENTE, C. SOUZA, S. FREIRE & F. BAQUEIRO. Language Function Regulation: a propose of a instrument to differential diagnostic of Fragile X Syndrome.**

**Objective:** To describe a neuropsychological profile of participants with suspect of Fragile X Syndrome.

**Participants and Methods:** 29 male participants with age between 3 and 45 years old in Salvador-Bahia-Brazil. The Human Figure Test and Motor Combined Method (Luria, 1985) were applied to each one. Data was analyzed by SPSS 8.0 with frequency comparison of performances and Pearson chi-square.

**Results:** 13.8% of participants obtained success in Motor Combined Method while 65.5% didn't answer and 20.7% was impossible to evaluate. When the speech of subject was added as auxiliary sign, the performance improved to 44.8%. The Human Figure Test and Motor Combined Method showed a high correlation among results. The participants who had the best performance in Motor Combined Method also had the best performance in drawing of human figure as well as the participants classified as mental deficit were the same subjects who didn't control their behavior through language regulation function.

**Conclusions:** The effect of language as behavior regulator had importance to explain frontal lobe development and the Motor Combined Method was an important instrument to differential diagnostic of participants with suspect of Fragile X Syndrome.

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**F.F. BARBOZA, T. SOLEDADE & C. BONFIM. Development of the Regulatory Function of the Language and Frontal Maturation in different ages in a public Creche in the City of Salvador – Bahia – Brazil.**

**Objective:** verifying when the regulatory function of the language stabilizes itself, that is, when the children are able to use their own language to regulate their behavior.

**Participants and Methods:** 104 students from a public Creche in Salvador – BA/Brazil took part in the experiment (50 males and 54 females) divided equally between the groups 03, 04 and 05. The combined motor method was applied individually, an evaluation method developed by Luria in 1958. The analysis of the this data was done through the database built in the SPSS version 8.0, making it possible to evaluate the individual scores of each child in the test.

**Results:** There was a significant difference between the results of different groups. In group 03, only 2.22% were successful in the evaluation. In Group 04, 50% were successful in the evaluation, among those 26.6% finished the evaluation without external speech and 73.4% used this tool. In Group 05, 93.4% finished the activity with success, among those 78.5% finished it without the need of external speech and 21.5% needed it to finish the activity with success. It was also verified that there was a statistically considerable correlation between the phases of the evaluation ( $p=0,00$ ).

**Conclusions:** There is an instability in groups 03 and 04 but in group 05 the expected stability and consequent maturation of the frontal lobe is verified and is responsible for the act of planning and controlling the motor actions.

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**M.T. BARISA, T. KAIP, M. LANCASTER & L.D. PORTER. A Case Presentation of Capgras Syndrome and Reduplicative Paramnesia in a Patient With Probable Frontal Lobe Dementia.**

**Objective:** Capgras syndrome and reduplicative paramnesia are believed to be the result of lesions involving the right cerebral hemisphere and frontal lobes. The characteristic feature of Capgras is a delusional misidentification wherein an individual believes that a person, most often a loved one, has been replaced by an imposter. Reduplicative paramnesia is characterized by a belief that a place/location has been duplicated and exists simultaneously in two or more places. This poster presents an overview of these syndromes through a case involving an elderly male with suspected frontal lobe dementia with Capgras and reduplicative delusions.

**Participants and Methods:** The presentation includes results from the medical diagnostic work-up, neuroradiological examination, speech-language pathology assessment, and neuropsychological evaluation.

**Results:** The patient has a history of stroke and hepatic dysfunction. His wife reported concern for the patient's belief that she, at times, had been replaced by multiple imposters who "look like my wife but are not really my wife." Additionally, he reported a belief that an alternate version of his home and its furnishings existed in another area of his city and was featured on a television documentary. These beliefs were accompanied by personality changes including disinhibition and dysregulation of emotional functioning. Neuropsychological findings demonstrate deficits associated with damage in the right cerebral hemisphere and prominent frontal disturbance.

**Conclusions:** The case study is significant given the uniqueness of Capgras syndrome and reduplicative paramnesia. Recognized and discussed in the literature, such cases are rarely seen in clinical settings and the current case study sheds light on the syndromes through a clinical case. Correspondence: *Mark T. Barisa, Ph.D., Neuropsychology, Baylor Institute for Rehabilitation, 909 N. Washington Ave., Dallas, TX 75246. E-mail: mbarisa13@yahoo.com*

**M. BUELOW & J. SUHR. Personality and State Mood Affect IGT Performance.**

**Objective:** The Iowa Gambling Task (IGT) is often used to assess risky decision making in clinical populations. Cognitive ability, state affect, and personality have been shown to impact IGT performance. The present study further examined the role of negative affect, impulsive sensation seeking, and behavioral activation and inhibition in IGT performance.

**Participants and Methods:** Participants were 111 undergraduates (46 male, ages 18-24, mean age = 18) who completed measures of impulsive sensation seeking, behavioral activation and inhibition, state mood, WASI Vocabulary and Matrix Reasoning, and the IGT as part of a larger study.

**Results:** Performance on the IGT (advantageous minus disadvantageous selections on Blocks 4 and 5) did not differ as a function of gender ( $p > .10$ ) or cognitive ability ( $p > .10$ ). A hierarchical linear regression on IGT performance was conducted, with negative mood entered in Block 1 and personality variables entered in Block 2. Increased negative mood was marginally related to poor IGT performance ( $r^2 = .047$ ,  $p = .060$ , partial  $r = -.22$ ). After accounting for negative affect, the personality variables accounted for an additional 11.8% of the variance in IGT performance ( $p = .048$ ). Specifically, high Drive was marginally related to worse IGT performance ( $p = .065$ , partial  $r = -.18$ ).

**Conclusions:** Consistent with prior research, personality and negative state mood were associated with IGT performance during "decision making under risk." The results indicate that personality and mood variables should be considered when utilizing the IGT to assess decision making deficits in clinical populations, as these variables may affect interpretation of findings. Correspondence: *Melissa Buelow, M.S., Psychology, Ohio University, 200 Porter Hall, Athens, OH 45701. E-mail: mbuelow@gmail.com*

**C. CHEN & R.C. CHAN. A cross-sectional and longitudinal study of multitasking performance in school-aged children.**

**Objective:** Recently, researchers have developed some multitasking tests with impressive ecological validity. However, few studies have examined

the development of multitasking performance of typically developing children. The present study aimed to capture the multitasking performance of school-aged children from 7 to 11 years old with two children versions of multitasking paradigms: the Modified Six Elements Test for Children (SET-C) and the Battersea Multitasking Paradigm (BMP).

**Participants and Methods:** We adopted a combination of cross-sectional design ( $N=86$ ) and a longitudinal design (follow up at 1 year) ( $N=84$ ) to address this issue.

**Results:** The results of cross-sectional study showed that there was remarkable development of retrospective memory, prospective memory, strategy application and intentionality in 7 to 11 year-old children, but the development of planning and monitoring was not distinct. The results of longitudinal study implied that children from 7 to 9 years of age had undergone a rapid growth of prospective memory, strategy application and intentionality, but such development slowed down after age of 11. The development of retrospective memory had been rapid and steady. Planning had undergone moderate development, while the growth of monitoring ability was not significant.

**Conclusions:** The current study provides one of the very few empirical findings to show the developmental profile of multitasking performance in school-aged children.

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**R.C. CHAN, B. YANG & L. LIN. Prevalence of neurological soft signs and their neuropsychological correlates in healthy Chinese children.**

**Objective:** The current study aimed to examine the prevalence and developmental pattern of neurological soft signs in a group of healthy Chinese children.

**Participants and Methods:** Two hundred and nine healthy children participated in the current study. An abridged version of Cambridge Neurological Inventory (CNI, Chen et al., 1995) was used to assess the presence of neurological soft signs. Moreover, all children were administered with a set of neuropsychological tests.

**Results:** We found that the prevalence of the individual neurological soft signs was relatively larger in younger age groups ( $F(21,603)=9.09$ ,  $p<0.0005$ ). Boys demonstrated more motor coordination signs compared to girls ( $F(1, 269)=11.196$ ,  $p=0.001$ ). However, there was no significant effect of handedness in the present sample. Motor coordination signs were significantly correlated with performance on the Wisconsin Card Sorting Test (WCST) (categories and perseverative errors) ( $p<0.0005$ ) and the Verbal Fluency Test ( $p<0.001$ ), whereas disinhibition signs were significantly correlated with Stroop interference performance ( $p<0.01$ ), WCST categories ( $p<0.0005$ ) and perseverative errors ( $p<0.0005$ ). Sensory integration was also associated with WCST categories ( $p<0.05$ ) and Verbal Fluency ( $p<0.05$ ). Such relationships remained significant after controlling for age and IQ in healthy controls. There were age and gender effects on the CNI subscales, especially on the sensory integration subscale. Younger children were associated with higher prevalence of neurological soft signs. Boys demonstrated more motor coordination signs than girls. However, no significant effect of handedness was found among the present sample.

**Conclusions:** This study provides some of the limited developmental data available concerning neurological soft signs in healthy Chinese school-aged children. We hope that these data will lead to cross-cultural developmental neuropsychological studies in the near future.

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**L. LIN & R.C. CHAN. Developmental patterns in the detection of faux pas in healthy school-aged Chinese children: Relationship to executive functions.**

**Objective:** This study attempted to examine the development of the detection of faux pas and its relationship to executive functions in healthy school-aged Chinese children.

WITHDRAWN

**Participants and Methods:** One hundred and thirty-eight school-aged children, from 6 to 11 years old, were recruited. All of them received a comprehensive battery of tests, including a IQ test, executive function tests, first- and second-order false belief tests, and a detection of faux pas test.

**Results:** The results showed that there was a general increase in the ability to detect faux pas with age [ $D(75, 124) = 12.77(p < .001)$ ] and that girls tended to outperform boys. Chinese children preferred to make moral judgments when attempting to understand faux pas. Verbal ability was strongly correlated with the detection of faux pas ( $r = -.19$ ;  $p < .05$ ), even when age was controlled for ( $r = .28$ ;  $p < .01$ ). Moreover, significant relationships were found between the detection of faux pas, the WCST perseverative response, and verbal fluency, even when age was controlled for. When these factors were taken together, there was a general increase in the ability to detect faux pas in school-aged Chinese children.

**Conclusions:** The empirical finding that the development of this ability parallels verbal ability and executive function suggests that there is some overlap between these constructs in typically developing children.

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#### S.E. CHRIST, A. MOFFITT & D. PECK. Early-Treated Phenylketonuria and Prefrontal Dysfunction: Evidence from Functional Magnetic Resonance Imaging.

**Objective:** Phenylketonuria (PKU) is rare genetic disorder characterized inefficient metabolism of phenylalanine into tyrosine, an essential precursor of dopamine. Consistent with notion that the PFC is particularly susceptible to dysregulation in dopamine, previous behavioral studies by the PI and others (e.g., Christ et al., 2006) have documented impairments in executive control and other PFC-mediated abilities. In the present study, the researchers utilized fMRI to further elucidate the nature of this impairment.

**Participants and Methods:** Six individuals with early-treated PKU (mean age = 18.3 years) and six neurologically intact individuals (mean age = 18.4 years) were imaged while performing two tasks: (1) a 2-back working memory task, and (2) a control "X-back" task. Neural activity recorded during performance of the working memory task was contrasted with that recorded during performance of the control task.

**Results:** A voxel-wise analysis revealed regions in the left inferior frontal gyrus and bilateral superior frontal gyrus that showed a significant interaction between condition (2-back vs. X-back) and group (PKU vs. control),  $F(1, 10) = 46.8$  &  $13.5$ , respectively,  $p < .05$  FDR-corrected in both instances. Whereas the two groups showed equivalent activation in the regions during the control task, the non-PKU group showed substantially more activation in these regions during the working memory task as compared to the PKU group.

**Conclusions:** Taken together with prior behavioral findings, the present results provide converging evidence of prefrontal dysfunction in individuals with early-treated PKU. Results are discussed within the context of our current understanding of PKU and executive control.

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#### K. COULEHAN, K. ERICKSON, M. AHRONOVICH, F. LITMAN & I. BARON. Early School-age Executive Functioning of Extremely Low Birth Weight Infants with Bronchopulmonary Dysplasia.

**Objective:** Extremely low birth weight (ELBW; <1000g) infants are at an increased risk for executive dysfunction at school-age. We sought to determine whether bronchopulmonary dysplasia (BPD), a chronic lung disease associated with long-term neuropsychological impairments, may exacerbate these deficits.

**Participants and Methods:** We assessed executive functioning in 69 ELBW infants at school-age and 23 full-term healthy controls (HC; CA =  $6.60 \pm 0.28$ ). Forty-three ELBW infants had developed BPD (BPD; CA =  $25.56 \pm 1.67$  weeks; CA =  $6.49 \pm 0.65$ ) and 26 had not (NBPD; CA =  $27.54 \pm 2.82$  weeks; CA =  $6.89 \pm 0.84$ ).

**Results:** Children with BPD had significantly lower scores than HC on DAS immediate recall of objects, DAS matrices, WISC-III digit span, Corsi block-tapping span, letter fluency and animal fluency. NBPD children performed significantly below HC on DAS sequential and quantitative reasoning. A single significant difference between ELBW groups was found on letter fluency (BPD < NBPD,  $p = .031$ ). Birth weight (BW) was significantly lower in the BPD group. After controlling for BW, letter fluency (BPD < NBPD;  $p = .034$ ) remained significant. Teacher questionnaires evaluating executive functioning after controlling for BW revealed increased difficulty for BPD compared to NBPD children for shifting attention, emotional control, planning and organizing, and initiation.

**Conclusions:** Lower BW appears to have an adverse effect on neuropsychological outcome; however, these data suggest that BPD further increases the risk of executive function deficits at school-age. Prevention and treatment of BPD is needed to avoid long-term academic difficulties related to executive function deficits in ELBW infants.

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#### E. DAWSON, P.K. SHEAR, S. HOWE & S. STRAKOWSKI. Impulsivity and Social Functioning in Healthy Young Adults.

**Objective:** Impulsivity is a common feature of many neuropsychiatric disorders and is thought to contribute both positively and negatively to behavior. The current study sought to elucidate the relationship between impulsivity and social functioning in healthy adults in order to provide a foundation for similar research in people with psychiatric disorders.

**Participants and Methods:** Eighty-nine healthy undergraduate students (57% women; 82% White) were included in this study. Scores on the Barratt Impulsiveness Scale, 11th edition (BIS-11); the Behavior Rating Inventory of Executive Functions, Adult version (BRIEF-A); the Delis Kaplan Executive Function System Color Word Interference Test (DKEFS); and the Degraded Stimulus Continuous Performance Test (DS-CPT) were used to predict scores on the Social Adjustment Scale – Self Report (SAS-SR). The Beck Depression Inventory, second edition (BDI-2) was also included to examine the effects of depressive symptoms on both impulse control and social functioning.

**Results:** Simple correlations revealed that better executive functioning and impulse control were associated with better social functioning. Fewer depressive symptoms were also associated with better social functioning. Multiple regression analysis revealed that the BIS-11 and BRIEF-A were significant independent predictors of the SAS-SR. BDI-2 scores were added to the model and were found to contribute significant unique variance beyond that explained by the BIS-11 and the BRIEF-A.

**Conclusions:** The results of this study suggest that better self-reported impulse control, better executive functioning, and better mood were related to higher social functioning, even in a healthy sample that displayed normal social functioning.

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#### G.H. CHANG, R.K. DIPINO, C. SIRBU & V. SMITH. Examination of the Relationship between Executive Cognitive Function and Psychopathology in Individuals with Traumatic Brain Injury.

**Objective:** This study examines the relationship between executive function (EF), aggression, and depression in TBI patients. Our hypotheses are: a) scores of executive function will be negatively correlated with scores of aggression and depression from the Personality Assessment Inventory (PAI) in patients with TBI, b) there will be a positive relation-

ship between depression and aggression., c) there will be an association between age and EF, and d) scores on measures of EF will be associated with levels of education. An overall PAI profile is examined to explore general patterns of psychopathology among individuals with a history of TBI.

**Participants and Methods:** A total of 49 cases are included in the study. Scores from the Trail Making Test, Wisconsin Card Sorting Test (WCST), and the Similarities and Matrix Reasoning sub-test of the WASI are examined along with results of the PAI.

**Results:** Results indicate a negative relationship between aggressive attitudes and overall cognitive flexibility in individuals with TBI. There is a significant linear relationship between depression, aggressive attitudes and levels of physical aggression. Significant differences were found among older TBI patients compared to younger patients on the WCST. Those with higher levels of education performed better on measures of verbal and non-verbal reasoning. Examination of PAI profiles revealed moderate elevations on 10 out of the 18 scales with the greatest elevations occurring on the Somatization, Anxiety, and Depression scales.

**Conclusions:** Future research is warranted to further explore the relationship between EF and psychopathology. The PAI appears to be an effective instrument for this purpose.

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#### A. EASTVOLD, E. FRANCHOW, R. GREEN, J. HUDAK, R. THIEROLF, D. STRASSBERG & Y. SUCHY. Reduced processing speed in adult pedophilic men.

**Objective:** There is evidence suggesting that pedophiles exhibit brain abnormalities in frontal and/or temporal regions, although published findings vary, likely due to the use of differing definitions, sample criteria, measures and comparison groups. The purpose of this study was to assess neurocognitive functions subserved by the frontal lobes and frontostriatal pathways.

**Participants and Methods:** Adult pedophilic men (n=29), non-pedophilic child molesters (n=29) and nonsexual offenders (N=30) were administered select subtests from the Delis Kaplan Executive Function Scale, the Wechsler Adult Intelligence Scale, Third Edition and the Shipley Institute of Living Scale. Pedophilic status was determined via penile plethysmograph. Variables were combined into domain composites: Processing Speed, Working Memory, Executive Functions, and Intelligence.

**Results:** Analyses of covariance (covariates: age, education) revealed significant group differences in processing speed [ $F(4,86) = 3.2, p < .05$ ], executive functions [ $F(4,86) = 2.7, p < .05$ ], and intelligence [ $F(4,86) = 11.7, p < .01$ ]. After adding a third covariate, a composite of vulnerabilities (history of alcohol dependency, drug dependency, attention deficit disorder, left-handedness, head-injury with loss of consciousness) the significant group differences in processing speed and intelligence remained, but not those in executive functions. Overall, pedophiles were more intelligent than nonsexual offenders, but exhibited slower processing speed, even after accounting for factors known to affect processing speed, i.e., age, education and neurologic comorbidities. Nonpedophiles typically performed intermediate to the two groups.

**Conclusions:** This evidence of slower processing speed is consistent with a previous report of reduced response speed among pedophiles (Whittaker, 2007) and also provides corroborating neuropsychological evidence of a recent publication documenting lower white matter volumes among pedophiles (Cantor, 2008).

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#### S. FOSTER, R.E. CORNWELL & H.P. DAVIS. Wisconsin Card Sort Across the Lifespan (5 – 89): Cognitive Abilities Contributing to Performance.

**Objective:** The cognitive variables contributing to Wisconsin Card Sort Task (WCST; an executive function measure) performance have

been inconsistent across studies. Cognitive changes across age groups and the use of different dependent variables may contribute to the confusion. We explored these factors, expecting performance differences across the lifespan, as well as age-related differences in the cognitive abilities contributing to performance. Further, we expected cognitive abilities predicting performance to vary with the dependent measure [i.e., categories completed (CC) and perseverative errors (PE)].

**Participants and Methods:** Our sample included children (CH; 5-19, n=173), younger adults (YA; 20-49, n=130), and older adults (OA; 50-89, n=207). All participants completed tests assessing verbal and visual working memory, reaction time, inhibition, and fluid intelligence, as well as the WCST.

**Results:** OA (M=4.31, SD=1.85; M=20.54, SD=12.39) performed more poorly than CH (M=5.11, SD=1.42; M=13.98, SD=8.44) and YA (M=5.36, SD=1.37; M=13.32, SD=9.20) as measured by CC and PE, respectively; however, CH and YA performed equivalently. The five underlying cognitive variables (i.e., verbal and visual working memory, reaction time, inhibition, and fluid intelligence) significantly predicted performance in five of six analyses: CH( $F[5,167]=11.75, p < .01$ ;  $F[5, 167]=8.57, p < .01$ ); YA( $F[5,124]=1.95, p = .09$ ;  $F[5, 124]=3.54, p < .01$ ); OA( $F[5,201]=7.41, p < .01$ ;  $F[5, 201]=9.41, p < .01$ ); shown as CC and PE, respectively, for each group. Variables contributing to performance were dependent on age group and dependent variable.

**Conclusions:** Individuals whose executive functioning abilities are not fully functional (e.g., children & older adults) may recruit other cognitive abilities to enhance performance. Additionally, comparing findings across WCST studies that use different dependent variables is inappropriate.

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#### S. FOSTER, S.M. HORNING & H.P. DAVIS. Planning (TOH) Across the Lifespan (5-89): Cognitive Abilities Contributing to Performance.

**Objective:** Studies of cognitive abilities underlying performance on the Tower of Hanoi (TOH), a problem-solving task, have produced inconsistent results. Cognitive changes across the lifespan and/or varying task complexity may explain these inconsistencies. We explored cognitive abilities underlying performance on 3- and 4-ring puzzles (TOH-3 and TOH-4, respectively) in individuals aged 5 to 89. We hypothesized that different cognitive functions would predict TOH-3 and TOH-4 performance, and that the underlying abilities would vary by age group.

**Participants and Methods:** Participants (N=525) included children (C; 5-19, n=179), younger adults (YA; 20-59, n=174), and older adults (OA; 60-89, n=170). They completed tasks assessing attention, processing speed, verbal and visual working memory, shifting, and fluid intelligence.

**Results:** We conducted standard regression analyses to explore the contributions of these six underlying abilities to TOH-3 and TOH-4 performance. On TOH-3, the six abilities significantly predicted performance in all three groups (C: $F[6, 172]=9.89, p < .01$ ; YA: $F[6, 167]=2.64, p = .02$ ; OA: $F[6, 163]=3.16, p < .01$ ). Whereas on TOH-4, they significantly predicted performance in children( $F[6, 172]=7.20, p < .01$ ) and younger adults( $F[6, 167]=10.12, p < .01$ ), but not older adults( $F[6, 163]=1.83, p = .10$ ). The specific underlying abilities varied according to task complexity and participant age group.

**Conclusions:** When an individual's problem-solving abilities are not fully functional, he/she may recruit other cognitive abilities to complete the task, and these may vary as a function of age. Further, solution of TOH-3 and TOH-4 require different underlying cognitive abilities.

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**P.S. FOSTER, V. DRAGO, B. FERGUSON, G.P. CRUCIAN, F. SKIDMORE & K.M. HEILMAN. Depression and Lateral Onset Parkinson's Disease: Differential Effects on Working Memory.**

**Objective:** Research has examined the neurocognitive effects of depression in Parkinson's disease (PD), with depressed PD patients performing much worse than their nondepressed counterparts. However, no research has been conducted to determine whether the effects of depression on cognitive functioning in PD differ for patients with left hemibody onset (LHO) or right hemibody onset (RHO) of motor symptoms. Hence, we sought to investigate the differential effects of heightened depression in LHO and RHO PD patients on working memory. We predicted that LHO PD patients with heightened depression (HD) would perform worse on a measure of working memory than RHO PD patients with HD. No difference was predicted between LHO and RHO PD patients with low depression (LD).

**Participants and Methods:** A total of 75 PD patients completed the Geriatric Depression Scale (LD < 10; HD > 10) and were also administered the Digit Span subtest of the Wechsler Memory Scale – III.

**Results:** The results of a 2 (Onset: LHO and RHO) x 2 (Depression: LD and HD) between groups ANOVA indicated that the HD LHO patients ( $M = 33.83$ ,  $SD = 22.32$ ) performed significantly worse than the LD LHO patients ( $M = 61.81$ ,  $SD = 25.06$ ). Additionally, LHO patients with HD performed significantly worse ( $M = 33.83$ ,  $SD = 22.32$ ) than RHO patients with HD ( $M = 62.09$ ,  $SD = 20.76$ ).

**Conclusions:** These findings suggest that LHO PD patients may experience more disability in their activities of daily living. Future research should explore whether differences also exist between PD patients with and without diagnosed depressive disorders.

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**M.C. GARCIA, M. FERNANDEZ & N. LIM. The Effects of Bilingualism on Working Memory in an Attention-Deficit/Hyperactivity Disorder Population.**

**Objective:** Green (1998) proposed a model of bilingualism which states that bilinguals display enhanced inhibitory control of attention in non-language tasks, which results from repeated experience with inhibiting one language while speaking the other. Research from our laboratory (Harms & Fernandez, 2007) as well as from other laboratories support this model (Bialystok & Shapero, 2005). However, little is known whether this bilingual advantage of increased attentional control generalizes to clinical populations with attention problems such as to children diagnosed with Attention-Deficit/Hyperactivity Disorder (ADHD). Therefore, the purpose of this study was to compare bilingual and monolingual children diagnosed with ADHD on one measure of attention.

**Participants and Methods:** Children were compared on the Digit Span subtest of the Wechsler Intelligence Scale for Children, Fourth Edition. While the digits forward portion of this test requires little control, the digits backward portion requires planning, sequential processing and working memory.

Archival data from 255 monolingual and bilingual children with ADHD were analyzed.

**Results:** Independent samples *t* - tests were conducted separately on Digit Span Forward and Digit Span Backward comparing the monolingual and bilingual children. Results revealed that the bilingual group outperformed the monolingual group on Digit Span backward ( $p < .04$ ) supporting previous findings that suggest enhanced attentional control in bilinguals relative to monolinguals. Interestingly, on the easier Digit Span forward task, the monolingual group outperformed the bilingual group ( $p < .001$ ).

**Conclusions:** Our study suggests that the bilinguals do have an advantage over monolinguals on core working memory, attention, and inhibitory control as proposed by Green (1998).

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**M. HATFIELD-ELDRED & R. SKEEL. The Effect of Working Memory Capacity on Impulsive Decision-Making.**

**Objective:** Previous researchers have posited that individuals with limited working memory (WM) capacity have difficulty holding decision-making information in memory, which increases impulsive decision-making (Hinson, Jameson, & Whitney, 2003). However, other researchers have disagreed (Franco-Watkins, Pashler, & Rickard, 2006). The current study examined the relationship between WM capacity and decision-making. It was hypothesized that individuals performing a concurrent WM task would make more impulsive decisions.

**Participants and Methods:** Seventy-one undergraduate students participated. The Stoplight Task (SLT; Reilly, Greenwald, & Johanson, 2006), which requires integration of information about probability of loss and progress toward a goal, was used to assess decision-making. Participants randomly assigned to the WM load group engaged in a concurrent *n*-back task. WAIS-III Letter-Number Sequencing and Digit Span were used to assess WM capacity.

**Results:** For all participants, WM capacity correlated with SLT performance ( $r = 0.33$ ,  $p = .005$ ). Results of a 2 x 2 (WM condition x probability of loss) split plot ANOVA showed a significant main effect for probability of loss  $F(1, 138) = 24.69$ ,  $p < .001$ ,  $\eta_p^2 = .152$  and a main effect for WM condition that approached significance  $F(1, 138) = 2.22$ ,  $p = .14$ ,  $\eta_p^2 = .02$ . The interaction between probability of loss and WM condition was not significant  $F(1, 138) = .06$ ,  $p = .81$ .

**Conclusions:** All participants adjusted to different probability of loss conditions, but WM load participants made a greater number of impulsive decisions in both probability of loss conditions. These results support the theory that WM capacity influences impulsive decision-making. Correspondence: *Maegan Hatfield-Eldred, Central Michigan University, 2251 S. Nottawa Rd, Mt Pleasant, MI 48858. E-mail: maegan100@hotmail.com*

**D. ILARDI, T.G. BURNS & S.M. AMY. Executive Functioning Deficits Predict Academic Problems in Children with Sleep Disordered Breathing.**

**Objective:** Research suggests that children with sleep disordered breathing (SDB) are at risk for blood-gas disturbances that cause neurochemical/neuroanatomical aberrations in the prefrontal cortex (Beebe & Gozal, 2002). Furthermore, neuropsychological findings implicate executive dysfunction in children with SDB. The overarching goal of the current study is to assess the relationship between EF and academic functioning in children with SDB. Within the context of the Funnel Model by Meltzer (2007), which highlights EF areas that can be targeted for academic success, it was hypothesized that working memory, self-monitoring, shifting/flexibility, and planning/organization would predict academic performance.

**Participants and Methods:** Participants included 27 children (10 females; ages 8-18) who completed a sleep study and were referred for a comprehensive evaluation. As part of a larger study, a standardized neuropsychological battery was administered. Measures included in the current study were WISC-IV Digit Span (WISC-IV-DS); Tower of London-Drexel, (TOL-DX); D-KEFS Color-Word Interference Switching (DKEFS-CWS) and Trails Switching (DKEFS-TS); Woodcock Johnson Tests of Achievement-III, Letter-Word Identification (WJ-III-LW) and Calculation (WJ-III-C).

**Results:** Regression analyses indicated: EF skills predicted word reading (WJ-III-LW), with an  $R^2 = .59$ ,  $F(6, 25) = 4.54$  ( $p < .01$ ), and significant effects for WISC-IV DS ( $\beta = .40$ ,  $p = .01$ ) and DKEFS TS ( $\beta = .21$ ,  $p = .05$ ). EF skills also predicted math calculations (WJ-III-C), with  $R^2 = .61$ ,  $F(6, 25) = 4.94$  ( $p < .01$ ), and significant effects for WISC-IV DS ( $\beta = .49$ ,  $p = .03$ ) and DKEFS TS ( $\beta = .51$ ,  $p = .01$ ).

**Conclusions:** Results indicate that in children with SDB, weaknesses in cognitive flexibility and verbally mediated working memory can hinder their performance in reading and mathematics. Specific classroom interventions within the context of the Funnel Model by Meltzer (2007) will be reviewed.

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**J. JACKSON, S. ROPACKI, A. ZOUROS & R. RAO. Visuospatial performance and executive functioning in patients with spina bifida.**

**Objective:** This study examined how executive functioning influences the visuospatial deficits commonly found in spina bifida patients with and without ventricular shunts.

**Participants and Methods:** Thirty patients with shunts and 17 patients without shunts were recruited from a Loma Linda University outpatient medical clinic. The mean age in both groups was 41 years. Assent was received and all patients were administered a neuropsychological battery.

**Results:** Patients without shunts performed in the low-average range on visuospatial tasks (Block Design, Picture Completion, Picture Concepts, Perceptual Reasoning Index, and Rey-O copy). Patients with shunts performed significantly below ( $p < .05$ ) age appropriate norms, and patients in the no-shunt group. Regression analysis revealed a significant relationship between the number of shunt functions a patient has experienced and declines in visuospatial skills. ANOVA revealed that the visuospatial declines found in shunted patients were mediated by their executive skills. Nonshunted patients performed in the low-average range on executive tasks. Shunted patients performed significantly below nonshunted patients on tasks measuring executive type variables (WCST, trails-B, Design Fluency, and Rey-O copy). Executive skills were significantly correlated ( $p < .05$ ) to all measures of visuospatial and perceptual reasoning skills.

**Conclusions:** Spina bifida patients without shunts displayed visuospatial and executive skills that fell in the low-average range. Shunted patients performed significantly below the no-shunt group on all visuospatial and executive tasks. Ventricular shunting is significantly related to declines in visuospatial/perceptual reasoning skills and executive functioning. Executive functioning was found to mediate the relationship between shunting and visuospatial skills. Executive deficits appear to impair shunted patients ability to organize, understand, and manipulate visual information. These deficits are exacerbated with each shunt revision.

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**L.A. JACOBSON & R.C. PIANTA. Executive Function Skills and Children's Academic and Social Adjustment to Sixth Grade.**

**Objective:** Executive functioning (EF) skills are important for competent cognitive and social functioning across the life span. Research shows normative transitions, such as moving from elementary into middle-level schools, can significantly disrupt children's academic and social trajectories. EF skills may become critical during such transitions, however little is known about their role in children's adjustment to sixth grade. We investigated the relation between EF skills and sixth grade academic and social competence, including influences of school type and classroom expectations.

**Participants and Methods:** Children (N= 925) enrolled in the NICHD Study of Early Child Care and Youth Development completed measures of EF skills before and during elementary school, including the CPT, Day-Night Stroop, Delay of Gratification, Tower of Hanoi, and WJ-R Memory for Sentences. Sixth grade adjustment was assessed by teacher and parent ratings of social and behavioral competence in the classroom and community and teacher ratings of children's academic skills. Children rated perceived classroom expectations.

**Results:** Hierarchical regressions, controlling for family and child demographic characteristics, indicated that earlier EF skills significantly predicted sixth grade adjustment. Individual school x EF skill interactions were significant: parents reported more behavior problems and poorer regulatory control in children with poorer EF attending sixth grade in middle rather than elementary schools. In contrast, teachers reported greater academic and behavioral difficulty in students with poorer EF attending elementary schools.

**Conclusions:** Early EF skills contribute significantly to children's classroom and social competence during their sixth grade transition; type of school setting and classroom expectations interact with EF skills to influence children's adjustment.

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**K.M. JANKE, E.T. MAGARGEE & B.P. KLEIN-TASMAN. "Hot" and "Cool" Executive Functioning in Children and Adolescents with Williams Syndrome.**

**Objective:** Williams syndrome (WS) is a genetic neurodevelopmental disorder characterized by a distinct neurocognitive and behavioral profile including relatively spared language skills, impaired visuospatial abilities, hypersociability, heightened emotional reactivity, and anxiety (Mervis & Klein-Tasman, 2000). Structural and functional abnormalities of the amygdala and prefrontal cortex are also present (Meyer-Lindenberg et al., 2006). Research examining executive functioning (EF) abilities in WS is very limited. The goal of this study is to examine performance on measures of "cool" cognitive aspects of EF associated with the dorsolateral pre-frontal cortex and "hot" affective aspects of EF associated with the orbitofrontal cortex (Zelazo & Müller, 2002).

**Participants and Methods:** Participants were 13 children with WS, aged 6 to 15. Each was administered a measure of cognitive functioning (KBIT-II), "cool" executive functioning (DCCS), and "hot" executive functioning (Children's Gambling Task; CGT).

**Results:** Performance on the DCCS was significantly related to age ( $r = .696, p = .008$ ) and verbal IQ ( $r = .605, p = .029$ ). Considerable difficulty with this task was observed in comparison to age expectations, with only one child passing the border phase, a measure of cognitive flexibility and working memory. Performance on the CGT was not significantly related to age ( $r = -.200, ns$ ), IQ ( $r = .034, ns$ ) or to performance on the DCCS ( $r = -.147, ns$ ). The mean percentage of advantageous choices was 55.72% (SD = 34.49). Five children made more advantageous choices than would be expected based on random selecting ( $p < .05$ ).

**Conclusions:** Children with WS have difficulty with both "hot" and "cool" EF tasks. Potential relations to emotion regulation based on parental report will also be explored.

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**R.K. KESSLER, P.L. BRITNELL & T. GIOVANNETTI. What Accounts for Switching Difficulties in Schizophrenia?**

**Objective:** Individuals with schizophrenia exhibit impaired performance on the Trail Making Test (TMT). However, few studies have examined the component processes of this higher-level test to determine what accounts for difficulties. We utilized the TMT from the Delis Kaplan Executive Function System (D-KEFS) to examine whether scanning, sequencing, or motor difficulties explain impairments on the task's primary executive measure—switching.

**Participants and Methods:** Forty individuals with schizophrenia were administered the D-KEFS TMT which includes five trials— scanning, motor speed, two sequencing trials, and switching. The D-KEFS TMT produces scaled scores (SS) for each trial as well as contrast SS. Contrast SS are calculated by subtracting component process SS from the switching SS (e.g. scanning contrast SS = switching SS - scanning SS). We examined contrast SS to determine whether switching/executive difficulties can be explained by lower level problems.

**Results:** Participants demonstrated severely impaired performance on the task's primary measure (switching SS M = 2.19, SD = 2.66). Although scores improved when scanning and motor speed were taken into account, participants exhibited impaired switching (scanning contrast SS M = 6.90, SD = 3.21; motor contrast SS M = 5.48, SD = 3.29). However, when sequencing difficulties were accounted for, participants' switching improved dramatically and no longer fell within the impaired range (sequencing contrast SS M = 9.21, SD = 2.57).

**Conclusions:** Sequencing deficits best account for impaired performance on the executive/switching portion of the TMT. More studies should utilize the D-KEFS to examine the component processes that underlie tests of executive function.

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**W.D. KILLGORE, D.B. KILLGORE, N.L. CRUGLE & T.J. BALKIN. Odor Identification Ability Predicts Executive Function Deficits Following Sleep Deprivation.**

**Objective:** While it is well known that sleep loss affects elementary cognitive abilities such as alertness and vigilance, growing evidence suggests that sleep deprivation may also have profound effects on higher order cognitive capacities such as executive functions. Even a single night of wakefulness produces a significant decline in the metabolic activity of the prefrontal cortex. Furthermore, sleep loss has also been associated with significant declines in olfactory discrimination ability, a capacity that is reflective of the integrity of the orbitofrontal cortex. Therefore, we examined whether the magnitude of decline in olfactory discrimination at one night awake would be predictive of deficits in higher-order executive functioning after two nights without sleep.

**Participants and Methods:** Fifty four healthy volunteers were assessed with alternate short forms of the Smell Identification Test (SIT) 6 hours after waking from a full night of sleep and again following 24 hours awake. SIT change scores from baseline to 24 hours were calculated and then used to predict performance on the WCST administered after 45 hours of continuous wakefulness.

**Results:** SIT change scores at 24 hours were significantly correlated with performance on WCST Total Correct, Nonperseverative Errors, Conceptual Level Responses, and number of Completed Categories (all  $p$ -values  $< .05$ ). Interestingly, Perseverative errors and Perseverative Responses were not significantly predicted by SIT change.

**Conclusions:** Consistent with previous evidence of alterations in prefrontal functioning during sleep deprivation, declines in olfactory discrimination after 24 hours awake, a putative marker of prefrontal cortex activity, were significantly predictive of poorer performance on the WCST by 45 hours awake.

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**W.D. KILLGORE, T.L. RUPP, D.B. KILLGORE, N.L. CRUGLE & T.J. BALKIN. Differential Effects of Stimulant Medications on Verbal and Nonverbal Fluency During Sleep Deprivation.**

**Objective:** Although sleep deprivation impairs simple vigilance its effects on complex executive functioning are less consistent. Stimulants are often used to reverse the effects of sleep loss on alertness, but their effects on higher executive functions remain poorly understood. Three stimulant medications were compared for their effect on two complex fluency tasks, the Controlled Oral Word Association Test (COWA), which correlates with left prefrontal dysfunction, and the Ruff Figural Fluency Task (RFFT), which correlates with right prefrontal dysfunction.

**Participants and Methods:** Fifty-four healthy volunteers (29 males) were deprived of sleep for 61 hours. After 44 hours awake, participants received either a single dose of dextroamphetamine 20 mg, modafinil 400 mg, caffeine 600 mg, or placebo, and completed the executive function tasks after 48 hours of wakefulness, and again following a period of recovery sleep (12 hrs). The number of completed items and perseverations were examined.

**Results:** After controlling for education and performance IQ, the dextroamphetamine group significantly outperformed the placebo group ( $p < .05$ ) on the RFFT total score, although drug groups did not differ in the number of perseverative errors. In contrast, total words and perseverations did not differ among drug groups for the COWA. Following recovery sleep, groups were no longer significantly different for either task.

**Conclusions:** Overall, dextroamphetamine was superior to placebo at improving nonverbal figural fluency during sleep deprivation, without leading to a significant increase in perseverative responses, while none of the stimulants improved verbal fluency. Findings suggest that dextroamphetamine may be more effective at improving right than left prefrontal capacities during sleep deprivation.

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**C.E. KRUEGER, K. SAMUELSON & J.H. KRAMER. Executive Functioning in Children with Posttraumatic Stress Disorder.**

**Objective:** Rationale: Pediatric neuroimaging studies examining abused children with posttraumatic stress disorder (PTSD) found smaller cerebral and frontal cortex volumes and differences in the prefrontal cortex as compared to normal controls. Neuropsychological studies revealed deficits in attention and executive functioning in children with PTSD. However, these few studies used a non-trauma exposed comparison group, making it unclear whether the observed neuropsychological deficits are related to trauma exposure or to PTSD. The present study removed the confound of trauma exposure in order to ascertain if it is the trauma or the PTSD that negatively affects the brain.

**Participants and Methods:** Methods: The current study examined neuropsychological functioning in 18 abused children (ages 8-16) with current PTSD and 18 abused children without current or lifetime PTSD. Based on neuroimaging findings of prefrontal cortex dysfunction in children with PTSD, it was hypothesized that children with PTSD would show decreased performance on tasks mediated by the frontal cortex, including tasks of executive functioning, attention, and working memory.

**Results:** Results: Multivariate omnibus tests of significance were computed for each cognitive domain. Contrary to hypotheses, abused children with PTSD did not perform significantly worse on any measures of neuropsychological functioning than abused children without PTSD ( $p > .05$ ).

**Conclusions:** Discussion: Results suggest that neuropsychological differences found in previous studies may be explained by the effects of trauma, rather than PTSD. Previous findings may also be attributable to the adverse environments in which the majority of these children were raised. Alternatively, cognitive deficits in children with PTSD may not arise until later in life.

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**K.L. LOKKEN, A. BOEKA, R. CLEMENTS & M. WESLEY. Relationship between decision making and post-surgical weight loss following bariatric surgery.**

**Objective:** The Iowa Gambling Task (IGT) is a computer-administered task that is becoming increasingly used as a measure of "real life" decision-making. Difficulties in weighing short-term reward versus potential long-term deleterious consequences (i.e., decision-making) may provide a plausible explanation for refractory weight issues. This is the first study to examine the relationship between decision making ability and surgical outcome post-bariatric surgery.

**Participants and Methods:** Twenty-four obese individuals (62.5% Caucasian; 37.5 African American) seeking bariatric surgery were administered the IGT as part of a larger pre-surgical psychological screening evaluation. Mean age was 41 years (range 24 – 60) and mean education level was 14 (range 8 – 18 years). Participant pre-surgical Body Mass Index averaged 50.24  $k/m^2$  (32.32  $k/m^2$  – 66.86  $k/m^2$ ).

Weight loss in pounds was obtained by participants that were an average of 216 days/~7 months post-surgery (range 107 – 360 days). The IGT was scored according to standard procedure. Lower scores on the IGT indicate poor performance, and negative scores indicate a tendency to choose short-term rewards despite potential long-term negative consequences.

**Results:** Bivariate correlations showed significant positive correlations between post-surgical weight loss and IGT performance ( $r=.64$ ,  $p=.003$ ). Results indicated participants who performed better on the IGT lost more weight post-surgically, and those who had difficulty on the task were less successful with surgical weight loss outcome.

**Conclusions:** Although preliminary, the results of this pilot data suggest that decision making ability, within the context of other medical, psychological, and social variables, may be a predictor of post-surgical outcome following bariatric surgery.

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**E. LUBOYESKI, J.M. WINGO, C.R. ROACHE, E.R. TUMINELLO, D.C. DELIS & S. HAN. Self-Reported Executive Functions, College Adjustment, and the Mediation Effect of Depression.**

**Objective:** This study examined the relationship between self-reported executive functions (EFs), depression, and college adjustment. Previous research indicates EFs are related to adjustment problems in college. The current study proposes a model in which depression mediates the relationship between self-reported EFs and college adjustment.

**Participants and Methods:** Sixty-nine undergraduates (82% female), ages 18-24 (mean age 19, standard deviation 1.3 years) completed the Behavior Rating Inventory of Executive Function-Adult Version (BRIEF-A), Beck Depression Inventory-II (BDI-II), and College Adjustment Scale (CAS). Three mediational models were tested using regression analyses and following recommendations from Holmbeck (1997, 2002).

**Results:** In the first model, metacognition on the BRIEF-A was associated with depression on the BDI-II ( $p<.01$ ) and academic problems on the CAS ( $p<.01$ ). Depression was related to academic problems, with metacognition controlled ( $p<.001$ ). In the second model, behavioral regulation on the BRIEF-A was associated with depression ( $p<.01$ ) and interpersonal problems on the CAS ( $p<.001$ ). Depression was related to interpersonal problems, with behavioral regulation controlled ( $p<.01$ ). In the third model, behavioral regulation was associated with depression ( $p<.01$ ) and substance abuse problems on the CAS ( $p<.001$ ). Depression was related to substance abuse problems after controlling for behavioral regulation ( $p<.01$ ). In all three models, Sobel's test indicated significant reductions in the strength of the relationships between self-reported EFs and college adjustment problems after the mediator was introduced into the equation.

**Conclusions:** The current study provides evidence for a mediation effect of depression on the relationship between self-reported EFs and college adjustment outcomes. Further research is warranted to explore the exact nature of this relationship.

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**C.P. MCFARLAND, D.S. GORFEIN & E.L. GLISKY. Frontal Lobe Involvement in a Verbal Switching Task.**

**Objective:** Individuals with frontal lobe lesions demonstrate impaired performance in verbal switching tasks (Warrington, 2000). Because a decline in frontal function is often a consequence of normal aging, we were interested in whether older adults possessing poor frontal function would demonstrate impaired performance on a verbal switching task. In the present study we investigated the role of the frontal lobes in verbal switching among older adults.

**Participants and Methods:** Based upon their scores on a composite measure of frontal function, 24 older adults matched on age and education were characterized as possessing high- or low-frontal function, and were then tested on a task of homophone meaning generation. Optimal performance on this task requires participants to switch between verbal concepts in order to generate multiple meanings. Half of the homophones have a single spelling, and half have multiple spellings.

**Results:** High-frontal functioning participants generated significantly more meanings for the homophones than low-frontal functioning participants. Older adults generated more meanings to homophones that had multiple spellings compared to those with only a single spelling.

**Conclusions:** The findings of this study suggest that the declining frontal function seen in a subset of older adults results in difficulty switching between verbal concepts.

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**A. MOFFITT, S.E. CHRIST & D. PECK. The Relationship between Working Memory and Inhibitory Control in Individuals with Phenylketonuria.**

**Objective:** Phenylketonuria (PKU) is a genetically-based metabolic disorder associated with prefrontal dysfunction related to dopamine depletion and white matter abnormalities. Past studies have found impairments in prefrontally-mediated abilities such as working memory and inhibitory control in individuals with early-treated PKU. In the present study, we examined the relationship between the aforementioned aspects of executive function in individuals with and without early-treated PKU.

**Participants and Methods:** Eight individuals with early-treated PKU (Age: mean = 17.4 years; range: 11-27 years) and an age- and gender-matched comparison group of eight neurologically uncompromised individuals (Age: mean = 17.5; range: 12-27 years) participated. Secondary working memory demands (low vs. high) were manipulated while participants performed prosaccade (baseline) and antisaccade (inhibition) eye movement tasks.

**Results:** Results revealed that, whereas higher working memory load was not associated with poorer inhibitory performance for the comparison group, the working memory load manipulation had a marked effect on inhibitory performance for the PKU group,  $F(1, 10) = 7.95$ ,  $p < .05$ . We found that an increase in concurrent working memory demands resulted in a significantly greater drop in inhibitory performance for the PKU group (9.46% drop in accuracy rate) as compared to the control group (0.15% drop in accuracy rate). This remained true even after controlling for performance in the baseline task and individual differences in overall intellectual ability (IQ).

**Conclusions:** The current findings suggest that PKU-related impairments in cognitive abilities may be most apparent in situations requiring the coordination of multiple aspects of executive function.

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**A.E. MOLNAR & M.Y. KIBBY. Executive Functioning Deficits in Children with ADHD-C, ADHD-PI, and Dyslexia on the Parent and Teacher BRIEF.**

**Objective:** Executive dysfunction is frequently found in ADHD, but less is known about how executive functioning (EF) deficits vary across ADHD subtypes (ADHD-Combined [ADHD-C] and Predominately Inattentive [ADHD-PI] Types). Furthermore, despite the high comorbidity between ADHD and dyslexia, EF is less commonly studied in dyslexia. Hence, the goal of this study was to assess EF with the Behavior Rating Inventory of Executive Functioning (BRIEF) in 8-to-12 year-old children with ADHD-C, ADHD-PI, dyslexia, or controls.

**Participants and Methods:** Participants included 18 children with ADHD-C, 28 with ADHD-PI, 33 with dyslexia, and 50 controls. Groups were equated on age and maternal education. However, they differed in WISC FSIQ such that ADHD-PI and dyslexia groups had lower mean FSIQ than the ADHD-C and control groups. One MANOVA was conducted following the guidelines of Mahone et al. (2002) who suggested that IQ should not be used as a covariate when examining EF due to the high shared variance between the two.

**Results:** On the Behavioral Regulation Index (BRI) Teacher Form ADHD-C was rated more poorly than controls, while on the Parent Form ADHD-C was rated more poorly than ADHD-PI, dyslexia and controls. On the Metacognition Index (MI) Teacher Form ADHD-C, ADHD-PI, and dyslexia were rated more poorly than controls. On the MI Parent Form ADHD-C and ADHD-PI were rated more poorly than dyslexia, who were rated worse than controls.

**Conclusions:** Results suggest children with ADHD-C have a unique deficit in behavioral regulation while children with ADHD-C, ADHD-PI, and dyslexia all present with poor ratings of cognitive EF.

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**C.H. MORTON, M.A. SHANAHAN, B. KOPALD, J. STRICKLAND & L.D. STANFORD. Relationship between Parental Report of Executive Functioning Using the BRIEF and Child Performance on the TEA-Ch.**

**Objective:** Children are often referred for neuropsychological assessment with symptoms of executive dysfunction related to a variety of conditions. Previous studies, however, have often failed to find relationships between parental reports of executive functioning and performance-based measures. As such, newer measures have been developed to target different components of attention and other executive functions. The present study explored the relationship between parental report of executive functions and the performance-based subtests of Test of Everyday Attention for Children (TEA-Ch).

**Participants and Methods:** The current sample consisted of 63 clinic-referred patients between six and 15 years of age.

**Results:** Results indicated that there was little relationship between indices of the Behavior Rating Inventory of Executive Function (i.e., Behavioral Regulation Index, Metacognition Index) and individual subtests from the TEA-Ch ( $p$ 's  $> .05$ ,  $r$ 's  $< .27$ ). Follow-up analyses, however, revealed two moderate to low significant correlations between TEA-Ch subtests and BRIEF subscales. Specifically, parent-reported inhibitory control was related to visual search task time ( $p = .015$ ,  $r = .31$ ) and self-monitoring was related to cognitive flexibility on the TEA-Ch ( $p = .049$ ,  $r = .28$ ).

**Conclusions:** Overall, consistent with previous research, the BRIEF presumed to measure different aspects of executive function than those assessed by the TEA-Ch and raised questions regarding the ecological validity of neuropsychological measures of executive functioning. Thus, it is essential to obtain both parent report and objective neuropsychological data when assessing executive functions in children and to further explore the relationship of test performance and day-to-day functioning.

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**J. MOZEIKO, K. LÊ, C. COELHO, F. KRUGER & J. GRAFMAN. Discourse Performance Associated with Left Dorsolateral Prefrontal Cortex Lesions.**

**Objective:** The dorsolateral prefrontal cortex (DLPFC) is involved with motor planning, organization, and regulation. It plays an important role in the integration of sensory and mnemonic information and in cognitive regulation. Few studies have examined language function in DLPFC however lesions to this area have been noted to result in dynamic aphasia, characterized by impoverished language, notably reduction in propositions, response length and sentence complexity. This study examines the effect of left DLPFC lesions on discourse.

**Participants and Methods:** Narrative discourse of 6 participants with circumscribed left DLPFC lesions and 46 non-injured controls was analyzed. Brain lesions were delineated by CT scans and computerized analysis. Each participant retold a story narrative which was analyzed for grammatical complexity, completeness, story grammar, cohesion and local and global coherence.

**Results:** MANOVA indicated significant group differences across discourse measures. The left DLPFC group was significantly different from the non brain injured group on measures of cohesion, local coherence, global coherence, and completeness. No differences were observed on productivity, sentence complexity, and story grammar.

**Conclusions:** Results suggest that left DLPFC lesions do indeed result in impoverished language but not in response length, sentence

complexity, or story organization. Rather, language deficits are reflected by reductions in semantic content, integration and flow of story components, and thematic unity. While organization and regulation have been implicated with DLPFC function, findings suggest that the left DLPFC is more involved with semantic processing for discourse.

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**P.T. NGUYEN, S.K. LOO, A. TAANILA, L. HUMPHREY, I. MOILANEN, M. JARVELIN & S.L. SMALLEY. The impact of ADHD and reading deficits on working memory.**

**Objective:** Working memory (WM) deficits have been well documented in Attention-Deficit/Hyperactivity Disorder (ADHD), however, the type of WM deficit (i.e., auditory-verbal versus visuo-spatial) reported has been mixed. Reading deficits are present in ~25% of children with ADHD, and the impact of these difficulties on the type of WM deficit has not been well studied. The purpose of this study is to study the effects of ADHD and reading deficits on auditory-verbal and visuo-spatial WM tasks within a large sample of adolescents.

**Participants and Methods:** The sample consists of 452 adolescents (16-18-year olds) from the 1986 Northern Finnish Birth Cohort. Psychiatric diagnoses were made using a semi-structured diagnostic interview (KSADS-PL) and reading deficit (RDEF) was identified using a Finnish reading test. Adolescents whose reading fluency was in the slowest 10th percentile of the sample were classified as having a RDEF. The Wechsler Digit Span (DS) and Spatial Span (SS) were used to assess auditory-verbal WM and visuo-spatial WM, respectively.

**Results:** Analyses suggest that the type of WM deficit differed according to diagnostic group differences ( $p < .001$ ), with the ADHD + RDEF group ( $N=57$ ) associated with the lower scores in the auditory-verbal WM domain when compared to ADHD only ( $N=129$ ), RDEF only ( $N=47$ ) and controls ( $N=220$ ). Those with ADHD (alone or in combination with RDEF) had significantly lower scores in the visuo-spatial WM domain ( $p=.03$ ).

**Conclusions:** These findings suggest that the type of WM deficit is significantly impacted by whether the individual has ADHD, reading deficit, or the combination of the two.

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**B. PYYKKONEN, J.N. HOOK, D.Y. HAN & P. ROSKOS. An Analysis of the Unique Contribution of Executive Functioning, Language and Verbal Memory to Verbal Fluency Tasks Using Hierarchical Regression.**

**Objective:** Phonemic fluency tasks are often represented as a measure of both executive functioning and verbal ability. It is argued that phonemic fluency more closely resembles executive functioning while semantic fluency is a better measure of verbal ability. However, the unique contribution of these cognitive domains to these tasks is not clearly understood. We examined the unique contribution of executive functioning, verbal ability, and verbal memory to performance on both phonemic and semantic fluency.

**Participants and Methods:** This archival examination of clinically referred patients provided 66 and 34 subjects for the phonemic and semantic analyses respectively. Three variable blocks representing verbal ability, executive functioning, and verbal memory were entered into a series of hierarchical regression equations to identify the unique contribution of these variables to phonemic and semantic fluency. The executive domain included WCST and Trails B. Verbal domain included WAIS-III Vocabulary and Information and BNT. The verbal memory domain included Logical Memory II and Verbal Paired Associates II.

**Results:** The data were analyzed using a series of block-wise hierarchical regression equations with blocks of predictor variables entered in alternating sequence. The FAS model accounted for 30.5% of the

variance with 9.8, 7.7 and 2.5% of unique variability accounted for by verbal, executive, and verbal memory domains respectively. The semantic fluency model accounted 49.6% of the variance with 7.7, 10.3, and 2.1% of unique variability accounted for by verbal, executive, and verbal memory domains respectively.

**Conclusions:** Surprisingly, executive functioning represented a greater unique contribution to semantic fluency performance than verbal ability and verbal memory. In addition, verbal ability represented a greater unique contribution than executive functioning and verbal memory to phonemic fluency. Both hierarchical analyses provided surprising results with potential implications for future research and clinical use.

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**M.T. RANSOM, J. BREWER, S.L. WRIGHT, C.C. PERSAD, B. GIOR-DANI, L.A. BIELIAUSKAS, S. BERENT, H.A. BUCHTEL & S.A. LANGENECKER. Does Executive Functioning Differentiate Patients with MCI and Depression from Those with Depression Alone?**

**Objective:** Late life depression has been characterized as a disorder of fronto-striatal dysfunction, often presenting with executive function impairments. A subgroup of patients with late life depression present clinically with comorbid depression and Mild Cognitive Impairment, Amnesic Subtype (MCI-A), though it is unclear whether or not these patients represent a distinct group of older patients with depression. The purpose of the current study was to understand whether patients with comorbid depression and memory impairment (MDD+MCI-A) could be differentiated from patients with depression alone (MDD) on the basis of their performance on measures of executive functioning, as this may suggest disparate neurobiological etiology of the comorbid condition.

**Participants and Methods:** Seventy-one older adult individuals with a mean age of 70.9 ( $SD = 8.7$ ; 25 MDD and 46 MDD+MCI-A) who presented to a cognitive disorders clinic participated in the current study. The MDD+MCI-A group was psychometrically determined to have memory decrements via the Hopkins Verbal Learning Test-Revised ( $< 25\%$ ile on delayed recall) and both groups were free of cognitive difficulties in mental status, language, and visuospatial ability ( $> 25\%$ ile).

**Results:** Analyses of covariance, controlling for age, education, and Verbal IQ, revealed no statistically significant group differences on the Trail Making Test, Part B or the Wisconsin Card Sorting Test, Correct Responses ( $p > .05$ ).

**Conclusions:** These findings suggest that patients with MDD cannot be differentiated from patients with comorbid MDD and MCI-A on the basis of performance on tasks of executive functioning. Results are explained in the context of neurobiological origins of late life depression and cognitive impairments.

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**T.P. ROSS. The Reliability and Validity of Quantitative and Qualitative Scores for the Ruff Figural Fluency Test.**

**Objective:** This study examined the reliability and validity of quantitative and qualitative scores for the Ruff Figural Fluency Test (RFFT; Ruff, 1988).

**Participants and Methods:** Healthy undergraduates ( $N = 102$ ; M Age = 21.79; 87% Caucasian) were administered the RFFT, selected WAIS-III subtests, and measures of executive functioning.

**Results:** Using six raters, inter-scoring reliability was excellent (.9 range) for most RFFT indices. Test-retest coefficients ( $n = 102$ ; M interval = 7 weeks) ranged from .87 for novel responses to .64 for perseverative responses. A large practice effect was observed for overall performance, as participants generated 12 more novel designs, on average, when retested ( $t(1, 101) = 9.41$ ;  $p < .01$ ); interestingly, such effects were not observed for qualitative scores. RFFT novel responses and qualitative indices of strategic responding correlated with WAIS-III Block Design

performance, but qualitative indices only were associated with WAIS-III Vocabulary scores. Correlations between RFFT indices and putative measures of executive function varied widely and interesting patterns emerged. Timed measures sensitive to speed of information processing (e.g., Trail Making Test) correlated with quantitative but not qualitative indices. In contrast, measures sensitive to planning/strategic responding (e.g., Tower of Hanoi) correlated with qualitative measures but not quantitative scores.

**Conclusions:** The reliability of the RFFT was supported and these findings are consistent with previous research (e.g., Ross, Foard, Hiott, and Vincent, 2003). Few studies have examined the concurrent validity of RFFT scores. The present findings support Ruff's (1988) contention that RFFT qualitative indices are sensitive to strategic responding. The position that RFFT qualitative scores are "purer" measures of executive function is discussed in light of relevant models (e.g., Duncan, 1986) and directions for future research are presented.

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**S. LEININGER, M. HATFIELD, A. WEST, J. SOBANSKI, S. SZYMKOWICZ & R. SKEEL. Instructional Set Impacts Performance on the Iowa Gambling Task.**

**Objective:** The Iowa Gambling Task (IGT) (Bechara, Damasio, Damasio, & Anderson, 1994), has been used extensively to study decision-making under uncertainty in both clinical and non-clinical groups. The complexity of the IGT is illustrated by the large number of processes (e.g., affect shifting, approach-avoidance with both reward and punishment, reversal learning) hypothesized to be involved in completion of the task (Busemeyer & Stout, 2002; Fellows & Farah, 2005; Rogers et al., 1999). The current study explored the impact of instructional explicitness on learning patterns to highlight the role that awareness of costs and benefits plays in learning of the task. It was hypothesized participants given traditional instructions would learn more quickly than participants not given this information.

**Participants and Methods:** Fifty-nine participants completed the study. In a between subjects condition, one group was given explicit instructions highlighting "some decks are worse than others," while the other group was not informed of differential decks.

**Results:** A 2 x 5 (instructional condition x blocks of 20 trials) split plot ANOVA revealed an interaction between block and instructional condition,  $F(4, 54) = 3.14$ ,  $p = .021$ . Post-hoc tests indicated differences began to become evident in the third block, and were clearly demonstrated in the 4th and 5th blocks.

**Conclusions:** The rapidness of the appearance of differing performance contrasts with previous research in the area (Fernie & Tunney, 2006), and suggests researchers will want to carefully consider instructional set when both reviewing prior research and designing novel studies.

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**L.G. SORENSEN, K. NEIGHBORS, K. MARTZ, F. ZELKO, J.W. VARNI & E.M. ALONSO. Executive Functioning Following Liver Transplantation in Early Childhood – Preliminary Results of the Functional Outcomes Group (FOG).**

**Objective:** Problems with attention and executive functioning (EF) are hallmarks of hepatic encephalopathy and are often reported in pediatric liver transplant (LT) recipients, but have not been systematically examined in this population. We report on phase 1 of a longitudinal study assessing prevalence of EF problems among children post-LT.

**Participants and Methods:** 92 patients ages 5-6 who were 2+ years post-LT were recruited at 20 centers in the US and Canada through the Studies of Pediatric Liver Transplant (SPLIT) consortium for the ancillary FOG study. Parents and teachers completed the Behavior Rating Inventory of Executive Function (BRIEF) and the Pediatric Quality of Life Inventory, Cognitive Functioning Scale (PedsQL-CF).

**Results:** BRIEF teacher ratings were worse than published norms on all composites ( $p < .0001$ ) and subscales ( $p < .0001$  on 5 of 8 subscales). BRIEF parent ratings were also worse than norms for the Metacognition Index (MI) and General Executive Composite (GEC;  $p < .02$ ), but not the Behavioral Regulation Index (BRI). Compared to healthy norms, parent ratings on the PedsQL-CF were also worse ( $p < .0001$ ), and correlated better with BRIEF parent ratings (6 of 9 subscales;  $r = -.34$  to  $-.57$ ) than BRIEF teacher ratings (2 subscales;  $r = -.35$  to  $-.46$ ).

**Conclusions:** Results support anecdotal reports of executive problems in children following LT. Teachers report more serious and pervasive problems than parents, suggesting their input is critical. The PedsQL-CF also appears to tap executive function in children following LT, but may be more reflective of parent than teacher perceptions. Phase 2 of the FOG study will examine whether EF deficits increase when participants are retested at ages 7-9. Supported by R01 HD045694 (NICHD) and U01 DK061693 (NIDDK). The content is solely the responsibility of the authors and does not necessarily represent the official views of the NICHD, NIDDK, or the NIH.

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**U.S. SPRINGER, J. TROCHE, T. KUHN, G. CRUCIAN, H. FERNANDEZ, R. RODRIGUEZ, M. OKUN & D. BOWERS. Computerized Self-Ordered Working Memory Performance in Nondemented Parkinson Disease.**

**Objective:** Parkinson disease (PD) without dementia has been associated with executive dysfunction, including poor "strategic" working memory on the self-ordered pointing task (SOPT). We developed a software-based version of the SOPT to study strategic working memory in PD using abstract geometric designs and a new processing speed variable. We hypothesized that PD patients would show impaired self-ordered working memory related to reduced processing speed.

**Participants and Methods:** Forty-four idiopathic PD patients (Hoehn-Yahr 2-3) on levodopa medication were screened for dementia, mood disorders, and other neurological conditions. They received a comprehensive neuropsychological battery, and then completed the SOPT (16 stimuli, four sets of trials) along with 22 older and 26 younger controls.

**Results:** As revealed by ANOVA and post-hoc tests, PD patients and older controls demonstrated reduced strategic working memory on the SOPT relative to the younger group on several measures (accounting for random item selection). The PD group was significantly slower to respond per trial than both the older and younger controls, though this variable was unrelated to overall performance as well as neuropsychological measures of processing speed. No other differences in SOPT variables were observed between the PD and older control groups (errors, span, proactive interference, perseverative errors) despite adequate power.

**Conclusions:** Contrary to our hypothesis, the PD group performed comparably to older controls on untimed SOPT variables. This finding may relate to a) use of time-intensive compensatory strategies by the PD group (i.e., longer RT per trial), b) a floor effect with older adults when using abstract designs (vs. pictures or words), and/or c) research suggesting that medicated, non-demented PD patients perform normally on "storage" aspects of working memory tasks. Future studies with the computerized SOPT will address these questions by testing PD patients off and on medication and adjusting stimulus parameters.

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**D. STAVRINOS & D.C. SCHWEBEL. Assessing Executive Functioning In Children With Attention-Deficit/Hyperactivity Disorder, Combined Type.**

**Objective:** Both clinicians and researchers frequently assess executive functioning in children with ADHD, Combined Type (ADHD-C), but previous work is mixed concerning the optimal assessment strategy. Par-

ent-report measures are quicker and often easier to collect, but some have argued they offer poor construct validity when compared to a thorough neuropsychological test battery with the child. This study examined whether child performance on a neuropsychological executive functioning battery matched parent-report of executive functioning.

**Participants and Methods:** 32 children aged 7 to 10 (13 with ADHD-C, 19 controls) were recruited as part of a larger study. Exclusion criteria included non-stimulant medication use and mental retardation. Children participated off stimulant medications. Measures included the Attention/Executive Domain of the NEPSY and two parent report measures, Behavior Rating Inventory of Executive Function and Temperament in Middle Childhood Questionnaire.

**Results:** Although correlations between parent-reported executive functioning and child performance on the NEPSY were significant in the full sample, they were driven by ADHD symptoms. There were no significant intercorrelations (or trends) between child performance and parent report within either the ADHD-C or control group. Significant correlations emerged between the two parent-report measures in both groups. Independent-samples t-tests demonstrated significant differences between the 2 groups on all measures.

**Conclusions:** Although designed to tap similar constructs of executive functioning, we discovered poor associations between child performance and parent-report of executive functioning. Independently, the measures differentiated group status. These results highlight the need for clinicians and researchers to thoroughly evaluate children's executive functioning through multiple methods.

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**D. HAMMERS & J. SUHR. Who Fails the Iowa Gambling Task? Personality, Neuropsychological, and Neuroimaging Findings.**

**Objective:** The IGT is a measure of risky decision making designed to support diagnosis of brain dysfunction and to assess clinically relevant decision-making impairment. Early work on the IGT demonstrated that a significant minority of "normal" controls performed poorly. Reasons for IGT failure in healthy individuals are important to consider if one plans to use the IGT as a measure of clinically relevant risky decision making or to make conclusions about brain damage/dysfunction.

**Participants and Methods:** The present study explored factors related to IGT performance in a carefully screened sample of 58 healthy normal controls with no history of LD, ADHD, head injury with > 30 min LOC, major psychiatric diagnoses, other neurological history, or substance use other than alcohol.

**Results:** Of the 58, 14 failed the IGT based on recently published clinical norms. Those who failed were compared to the rest on sociodemographic, personality, and neuropsychological factors. Those who failed were not different from controls in age, education, gender, negative affect at IGT administration, number of alcoholic drinks per week, or age at which they started drinking alcohol. Those who failed were more likely to endorse impulsive sensation seeking personality characteristics and scored lower in estimated IQ. After controlling for intellect and personality, those who failed performed worse on a measure of working memory (2 back) and showed less frontal lobe oxygenation, particularly on the right (as measured with NIRS).

**Conclusions:** Results suggest that even in nonclinical samples, IGT performance is related to working memory and frontal lobe functioning.

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**E.E. SUNDERMANN, L.H. RUBIN, K. MORDECAI, E. EATOUGH & P.M. MAKI. The Effects of Stress and Oral Contraceptives on Cognitive Flexibility.**

**Objective:** Divergent and convergent thinking are forms of cognitive flexibility. Convergent thinking requires a structured processing mode, whereas divergent thinking requires an uninhibited processing mode.

Studies have found effects of stress on cognitive flexibility, yet the directionality of these effects is inconsistent. This study examined the effects of psychosocial stress on divergent versus convergent thinking. Moreover, the study also evaluated whether oral contraceptives (OCs) mitigate against any deleterious effects of stress on cognitive flexibility. The focus on OCs was based on evidence that OCs influence cognition and offer protection against the deleterious effects of cortisol on cognition.

**Participants and Methods:** Thirty-nine healthy females (18 OC users, 19 non-users; ages 18-40) in the midluteal menstrual cycle phase completed cognitive flexibility tests following a control and a stress condition. Parallel versions of a convergent thinking task (Compound Remote Associates Test [CRAT]), two divergent thinking tasks (Alternate Uses and Verbal Fluency) and a test of attention (Visual Search and Attention Test [VSAT]) were studied. The Trier Social Stress Test was the psychosocial stressor in the stress condition. Participants completed questionnaires in the control condition.

**Results:** Compared to the control condition, performance on the Alternate Uses decreased during the stress condition ( $p < .01$ ), whereas CRAT performance was significantly better during the stress versus control conditions ( $p < .05$ ). Verbal fluency and VSAT performance were similar between conditions. OC use had no independent or interactive effects (i.e., with stress) on any cognitive outcome.

**Conclusions:** Results suggest that stress worsens divergent thinking and benefits convergent thinking regardless of OC use.

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**R. TORRES, A. HEFFELFINGER, D. NAVARRO, K. BRINDOWSKI, J. GAGNE & H. GOLDSMITH. The Relationship Between Performance on Attention/Executive Functioning Tests and Parent Report of Externalizing Behavior Problems in Three-Year-Old Twins.**

**Objective:** The development of attention and executive functioning skills has received increased research consideration in recent years, although the relationship between performance on these tasks and behavioral problems remains unclear. The aim of this study was to evaluate the relationship between performance on attention/executive functioning measures and parent report of externalizing behaviors in a community sample of three-year-old twins. Performance on attention/executive functioning tasks was hypothesized to predict parent report of externalizing behaviors.

**Participants and Methods:** 126 three-year-old twins (63 twin pairs; 48% female) whose parents self-identified as ethnic minorities were recruited to participate as part of a larger twin study assessing emotion and temperament. Delayed alternation (Espy, Kaufman, McDiarmid, & Glisky, 1999) and a bead sorting task from the Preschool Laboratory Temperament Assessment Battery (Lab-TAB; Goldsmith & Reilly, 1993) were used to measure executive functioning and attention, respectively. Externalizing behavior problems were assessed via the 1½-5 Child Behavior Checklist. An age-appropriate item set from the Bayley Scale of Mental Development was also administered.

**Results:** Multiple regression analysis indicated that performance on attention/executive functioning measures and socioeconomic status did not predict parent report of externalizing behaviors. However, performance on the Bayley was a significant predictor of externalizing behaviors.

**Conclusions:** It is possible that participants' behavior problems adversely affected their cooperation or effort on the Bayley, but did not impact performance on executive functioning tasks due to the relative brevity of these tasks. Alternatively, lower overall cognitive abilities may contribute to delayed development of behavior regulation skills, resulting in increased parent report of behavioral problems.

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**T.D. WARNER, M. BEHNKE & F.D. EYLER. No Effect of Prenatal Cocaine Exposure on the Wisconsin Card Sorting Test Performance During Early Adolescence.**

**Objective:** To evaluate the effect of prenatal cocaine exposure (PCE), other drug exposures, and adjusted birth head circumference on executive functioning during early adolescence using the Wisconsin Card Sorting Test: Computer Version 4 (WCST:CV4).

**Participants and Methods:** Participants are rural, low SES, predominantly African American youngsters (N=250) from a prospective, longitudinal study whose mothers were enrolled when they first entered prenatal care or presented for delivery at a tertiary care hospital. Pregnant (mostly crack) cocaine users were identified by structured interviews and urine toxicology then matched to a non-cocaine-using comparison group based on race, SES, parity, and prenatal risk. Measures of prenatal drug exposures (cocaine, alcohol, tobacco and marijuana) were derived from structured interviews covering the 3 months prior to pregnancy and each trimester. Comprehensive neuropsychological evaluations, including the computerized WCST, were conducted by blinded examiners in a mobile clinic at age 12½ (~90% sample retention). Group comparisons using the Wilcoxon Rank Sum test and multiple regression analyses were performed on seven selected variables from the WCST (criterion of  $\alpha = .05$ ).

**Results:** No significant between-group differences were found for cocaine-exposed vs. non-exposed youngsters on any of the WCST variables. In addition, none of the hierarchical regression models yielded significant results.

**Conclusions:** The current study contributes to the mounting evidence that so-called "crack babies" do not, on average, show significant impairments in neurocognitive functioning. The results are generally consistent with the literature, in which the few significant effects of PCE have been of small magnitude.

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**M. WELSH, P. GORMAN BARRY & P. KLACZYNSKI. Predictors of High School Attrition among High-Risk Teenagers: Executive Function and Risk Assessment.**

**Objective:** The current study examined two cognitive domains, executive function and risk assessment, as potential predictors of attrition in an alternative high school serving adolescents who already have a history of academic and/or disciplinary problems in traditional schools.

**Participants and Methods:** Forty-six male and female high school students attending an alternative, charter school in a large metropolitan area of the U.S. were administered the BRIEF as a measure of self-reported executive functions, and the Risk Estimate Survey, a measure of the ability to assess risks and consequences in a variety of situations involving health, education, future relationship and financial outcomes, and behavioral reactivity. The two surveys were administered in January 2008 and again in late May 2008, prior to the end of the school year.

**Results:** Of the original student sample, 21 were still attending the school in May, while 25 students had left the school for a variety of reasons. The pretest scores on BRIEF subscales (e.g., inhibition, shifting, emotional control, working memory) and Risk Estimate subscales (e.g., health risks, education risks, etc) were analyzed to examine the degree to which they would effectively discriminate between the students who stayed in school and those who left. The MANOVA indicated that the two groups were significantly different on this set of variables,  $F(16, 29) = 2.082$ ,  $p = .04$ . Moreover, a discriminant function analysis demonstrated that these variables were effective in accurately classifying those students who stayed in school (90.5%) and those students who left school (88%).

**Conclusions:** This preliminary study indicated that executive functions, particularly self-reported task completion, flexibility, and inhibition, and risk assessment, particularly in the areas of health risk and educational future, are predictive of attrition among high-risk high school students.

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**M. WELSH, P. GORMAN BARRY & P. KLACZYNSKI. A Critical Thinking Skills Intervention for High-Risk Teenagers: Associations with Executive Functions.**

**Objective:** The current study examined the impact of a brief intervention in the form of the school-based curriculum, BrainWise, on a sample of very high risk high school students.

**Participants and Methods:** Forty-seven male and female students attending an alternative, charter high school were taught the BrainWise curriculum during the spring semester and administered the BRIEF self-report of executive functions at the pre- and post-intervention periods.

**Results:** An analysis of pre- to posttest changes on the BRIEF found that expected positive changes on executive functions did not occur; however, those students who were still in school ( $N=22$ ) at the posttest had significantly better pretest executive function scores than their peers who dropped out ( $N=25$ ). Correlational analysis indicated that the executive function scores predicted many of the students' reactions to BrainWise at the posttest period. Those students with the greater self-reported executive function difficulties indicated that individuals (themselves and others) would be less likely to make good decisions without the BrainWise program. Additionally, those with worse emotional control at pretest reported using more of the BrainWise skills. In contrast, executive functions did not predict their self-reported likelihood of making good decisions since learning BrainWise.

**Conclusions:** It appeared that those students who were in most need of a critical thinking program like BrainWise appreciated the negative effect that not learning these thinking skills would have on one's decision making skills. However, this relatively short exposure to the program had not yet persuaded them that their decision making skills had changed after learning BrainWise. One interpretation is that BrainWise had resulted in a more realistic perception of their current behavior and decision making skills, a finding that is consistent with the lack of positive change in executive functions at the post-intervention period. Correspondence: *Marilyn Welsh, Ph.D., School of Psychological Sciences, University of Northern Colorado, McKee Hall 14, Campus Box 94, Greeley, CO 80639-0121. E-mail: marilyn.welsh@unco.edu*

**J.M. WINGO, E.J. LUBOYESKI, E.R. TUMINELLO & D. HAN. Effects of Bilingualism on Executive Functions.**

**Objective:** Some studies have proposed that bilingualism may be associated with a delay in lexical acquisition and the development of a smaller vocabulary than that of monolingual children. Other research has pointed out that bilingualism in children is associated with increased meta-cognitive skills, superior divergent thinking ability, and better performance on some perceptual and classification tasks. These disparate results suggest the possibility that development of executive functions may differ as result of bilingualism versus monolingualism.

**Participants and Methods:** Forty-five undergraduate students (41 female and 4 male; mean age = 18.86,  $SD = 1.09$ ) were recruited for this study. Participants completed a neuropsychological battery that included subtests from the Delis-Kaplan Executive Functions System (D-KEFS), the Wechsler Abbreviated Scale of Intelligence, and a self-report questionnaire assessing multilingualism. Nineteen participants reported their language ability as bilingual and twenty-five participants reported their language ability as monolingual. The average age of acquisition for the second language was 10.50 ( $SD = 5.10$ ).

**Results:** Based on previous research, IQ was entered as a covariate in all regression analyses. Higher performance on Design Fluency Switching was associated with bilingualism ( $p < .05$ ). No significant relationships were found between more verbally-driven executive functions and bilingualism.

**Conclusions:** The current study provides preliminary evidence for an association between bilingualism and better performances on some measures of nonverbal executive functions. Future research is needed to elucidate the nature of this association.

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**D.J. WOOLSTON, L.H. LACRITZ & M. CULLUM. Construct Validity of the Texas Card Sorting Test (TCST) in Epilepsy.**

**Objective:** The TCST is a brief measure of creative card sorting and cognitive flexibility. Preliminary fMRI data have shown that the TCST robustly activates orbitofrontal subcortical regions that were not correlated with Wisconsin Card Sorting Test (WCST) activation. The current study further explored the validity of the TCST by comparing it with selected neuropsychological tests (including WCST) in individuals with epilepsy.

**Participants and Methods:** 31 subjects with epilepsy (M age=37, M education=13.3) were administered a battery of neuropsychological measures as part of a comprehensive seizure workup. Pearson's correlations were conducted to compare TCST, WCST, and other selected neuropsychological variables corrected for age and education.

**Results:** The total number of Logical Sorts (a primary score from the TCST,  $M=5.13$ ,  $SD=1.62$ ) was significantly related to general cognitive ability (estimated FSIQ  $r=.62$ , WRAT-IV Reading  $r=.55$ ), phonemic fluency ( $r=.55$ ), and Trails A ( $r=-.46$ ). The TCST was not, however, significantly correlated with WCST categories achieved, perseverative errors, or set failures. TCST perseverative errors were moderately related to nondominant (but not dominant) finger tapping ( $r=-.42$ ) and TCST set failures ( $r=.53$ ). Interestingly, the TCST variables were not significantly correlated with Trails B or category fluency.

**Conclusions:** This study, in conjunction with prior imaging findings, suggests that the TCST may measure a unique dimension of executive functioning, potentially related to orbitofrontal circuitry rather than dorsolateral frontal systems, given the lack of significant correlation between WCST and TCST variables.

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**L.M. WURST, K.L. POSSIN, M.E. GROWDON, V. LALUZ, B.L. MILLER & J.H. KRAMER. Set-Shifting is Associated with Left Middle Frontal and Right Superior Frontal Gray Matter Atrophy in Neurodegenerative Disease.**

**Objective:** Set Shifting tasks are commonly used measures of executive function. While prefrontal cortex (PFC) is understood to play a role, it is not clear which PFC regions are most involved. We examined the neural correlates of set-shifting in 200 subjects with neurodegenerative disease or neurologic controls using Freesurfer, a semi-automated parcellation program.

**Participants and Methods:** Subjects were administered the D-KEFS Trail Making Test that enables isolation of the set-shifting component. Regressions were performed to determine which regions of lateral PFC predicted completion time on Letter-Number Sequencing after controlling for: 1) Number Sequencing and Letter Sequencing, 2) Total intracranial volume and MMSE, and 3) Bilateral parietal and temporal volumes. In the final step, we entered inferior frontal, middle frontal, superior frontal, orbitofrontal, and anterior cingulate cortex. Separate regressions were performed for left and right hemispheres.

**Results:** Left middle frontal ( $R^2\text{change}=.036$ ,  $p=.003$ ) and right superior frontal gyri ( $R^2\text{change}=.035$ ,  $p=.032$ ) were the only regions to explain unique variance in set-shifting. When LMFG and RSFG were entered simultaneously, LMFG predicted shifting ( $p=.029$ ) and RSFG showed a trend ( $p=.081$ ).

**Conclusions:** Results suggest that both LMFG and RSFG are uniquely associated with set-shifting. While our LMFG findings are consistent with previous research, the RSFG findings are new. One potential model is that the left middle frontal gyrus is important for shifting and sequencing, and the right superior frontal gyrus is important for updating information in working memory.

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**R.E. YOASH-GANTZ, C.L. MCCORMICK, R. LUMPKIN, T. PICKETT & L. TUPLER. Relationship of Neurobehavioral Symptoms, PTSD and TBI in Returning Combat Veterans.**

**Objective:** The Global War on Terror (GWOT) has resulted in returning soldiers with mild traumatic brain injury (mTBI) and/or posttraumatic stress disorder (PTSD). Veterans report frontobehavioral deficit which could be explained by either mTBI, PTSD or both conditions. The current study goal was to compare frontal symptoms with TBI status (presence/absence) and level of PTSD. Frontal deficit, symptoms of PTSD and depression, and history of mTBI were obtained. The hypothesis was that those with mTBI or PTSD would report greater frontal deficit than those without mTBI or those with lesser PTSD.

**Participants and Methods:** Subjects were 126 veterans and active duty soldiers with recent combat service, recruited for the VISN6 MIRECC at the Salisbury, Richmond and Durham VAMCs. Participants were administered the Frontal Systems Behavior Scale (FrSBe), the PTSD Checklist (PCLM) and the BDI-II. History of mTBI was based on the ACRM criteria.

**Results:** Data were analyzed using SAS 9.1. Mean age was 31.5 years and 121 subjects were male. Caucasian (71%), African-American (21.5%), Hispanic (5%) and Asian (2.5%) comprised the sample. Mild TBI was diagnosed in 81 (64%) of the sample. Mean education for the TBI group was 12.94 and was 14.12 for those in the no TBI group. There was no difference in PCLM raw scores for TBI status ( $t=0.61$ ,  $P=.55$ ) or BDI-II raw scores for TBI status ( $t=0.83$ ,  $P=.41$ ). We used a general linear model ANCOVA with TBI status as a class variable and with age, education, PCL-M and BDI-II as continuous covariates. The model showed that age ( $P=.0095$ ), PCL-M score ( $P=.0136$ ) and BDI-II score ( $P=.0415$ ) were significant. The effect of TBI, however, was not significant ( $P=.3486$ ).

**Conclusions:** TBI status has no relationship to reported neurobehavioral deficit, PTSD or depression. The data indicate that self-reported neurobehavioral deficit is related to age, PTSD and depression. In fact, we found that age accounts for most of the variance in FrSBe scores, followed by PCL-M scores and BDI-II scores.

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**T.A. ZABEL, C. ZACHIK, E. LEVEY, S. KINSMAN & M. MAHONE. Discrepancies in parent- and self-report of executive dysfunction in youth with myelomeningocele and shunted hydrocephalus.**

**Objective:** Several studies using the parent report version of the Behavior Rating Inventory of Executive Functions (Parent-BRIEF) have documented patterns of executive dysfunction in children with myelomeningocele and shunted hydrocephalus (MMH). The current study utilized self-report to examine parent/child congruence of behavioral ratings and investigate self-perception of executive abilities in youth with MMH.

**Participants and Methods:** In the past (Mahone et al., 2002), we reported a general correspondence of raw score means from paired Parent/Self-Report BRIEF scales using a pre-publication (unstandardized) version of the Self-Report BRIEF (Self-BRIEF; Guy et al., 1998). Normative Self-BRIEF data was not available when the original data was published, and the current study is a data reanalysis using published age-based norms (Guy et al., 2004). Responses from the 31 original pre-publication Self-BRIEF forms collected during clinic visits were transferred to current Self-BRIEF forms, resulting in 25 complete protocols (age range=11-18, mean age=14.4 [s.d.=2.29]; 12 females).

**Results:** None of the mean Self-BRIEF composite scores (and only one of the subscale means: Task Completion) differed significantly from mean population values. Mean Parent-BRIEF T-scores were significantly higher ( $p<.01$ ) than mean population values for the Global Executive Composite (GEC), the Behavioral Regulation Index (BRI), and the Metacognition Index (MI). The mean Parent-BRIEF GEC ( $T=62.7$ ) and MI ( $T=63.2$ ) composites were significantly higher ( $p<.05$ ) than comparable Self-BRIEF means.

**Conclusions:** In contrast with our earlier report (2002), comparison of standardized scores from the Parent-and Self-BRIEF suggests significant parent/child discrepancies. Poor self-awareness of executive dysfunction in youth with MMH has implications for the initiation/completion of important medical self-care competencies.

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## Language and Speech Functions/Aphasia

**O. CHU, K. CHAUVIN, N. GIDAK & C. ABEARE. Neuropsychological Correlates of Clustering and Switching on the COWAT.**

**Objective:** The Controlled Oral Word Association test (COWAT) is a commonly used neuropsychological measure of verbal fluency, for which, supplemental indices have been created (Troyer, Moscovitch and Winocur, 1997). The supplemental indices initially included scores for clustering, or the grouping together of words in phonemic or semantic subcategories, and switching, the movement from one subcategory to another. More recently, Abwender, Swan, Bowerman and Connolly (2001) made the case for dividing the clustering score into phonemic and semantic clustering, and the switching score into cluster switches and hard switches. Abwender et al. demonstrated that this system was better able to capture different processes involved in the COWAT.

**Participants and Methods:** One hundred and forty-six undergraduate participants completed the COWAT (Benton, Hamsher, and Sivan, 1994), the Five-Point Test (Regard, Strauss and Knapp, 1982), California Verbal Learning Test-II (Delis, Kramer, Kaplan, and Ober, 2000), Trail Making Test part A and B (Army Individual Test Battery, 1944), Digit Span (Wechsler, 1997) and the Recognition Memory Test (Warrington, 1984). The COWAT was scored using the Abwender et al. (2001) method and these scores were correlated with performances on the other neuropsychological tests in order to examine evidence for the validity of the clustering and switching sub-scales.

**Results:** The total scores for clustering and switching showed distinct patterns of correlations with other measures. In addition, the sub-indices (phonemic vs. semantic clustering and cluster vs. hard switches) showed distinct patterns of correlations with other measures as well.

**Conclusions:** The current findings support the Abwender et al. argument for the validity of these sub-scales.

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**A. CANCELLIERE. Differential Performance In Naming Pictures Versus Definitions In Moya Moya Disease with Bilateral Cerebral Infarcts (left greater than right).**

**Objective:** The discrepancy between word finding for a picture (Boston Naming Test, BNT) versus a definition (Definition Naming Test, DNT) was illustrated.

**Participants and Methods:** In July, 2006 Ms. N, a 35-year-old teacher, sustained bilateral infarcts in the MCA territory, left greater than right, and bilateral ACA occlusions with right arm weakness, aphasia and Gerstmann's syndrome. MRI showed cortical infarction involving the left frontal lobe predominantly the middle frontal gyrus (3-4 cm) with a few small foci of ischemic injury in the corresponding right frontal lobe. There was severe narrowing of the distal right and left internal carotid and bilateral stenosis of the middle cerebral arteries with indications of Moya Moya type vessels.

**Results:** Testing 1.5 years later showed verbal comprehension and perceptual organization was average and low average. Working memory and processing speed were impaired. Verbal auditory attention/concentration was impaired but visual attention was average. Memory for faces was excellent but she performed poorly on memory tests requiring verbal responses (e.g., logical memory and family pictures). On the

WRAT4 reading, spelling and arithmetic fell at the 53rd, 18th and 2nd percentiles. Right-hand manual dexterity was severely impaired (left-hand borderline impaired). She demonstrated dysgraphesthesia, finger agnosia, perseveration, disorganization and severely impaired auditory perceptual capacities.

Performance on the BNT was excellent (59/60). Performance was impaired (18/36) on the DNT (read definition and provide word). Recognizing the target word from 20 options was excellent (35/36).

**Conclusions:** The DNT detected anomia where the BNT did not. This discrepancy was not related to visuo-perceptual disturbances or alexia.

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#### T.B. CRANFILL. Psychosocial Measures and Aphasiology.

**Objective:** To determine frequency and use of psychosocial measures during evaluations of persons with aphasia in rural and semi-rural areas in Kentucky.

**Participants and Methods:** Twenty licensed and certified speech-language pathologists (SLP) working in a variety of healthcare settings responded to an anonymous electronic survey regarding use of psychosocial measures during initial and/or post-treatment evaluations of persons with aphasia. Responses were examined for type/frequency of assessment, awareness of psychosocial measures, trends in assessment, and judgments on psychosocial influences on treatment outcomes.

**Results:** All respondents denied use of common psychosocial measures (i.e., Sickness Impact Profile, SF-36, Stroke Specific Quality of Life Scale -39). Functional Independence Measures (FIM) data were used for decision-making, but were not always completed by the SLP. Patients' perceptions on outcome, including their own mental, physical and social health, were gleaned largely through informal measures. SLPs reported priority being placed on administration of language or cognitive measures to determine level of function only.

**Conclusions:** Psychosocial aspects of aphasia are being assessed informally rather than with a degree of precision and objectivity. There is a need for psychosocial measurement in aphasiology to address issues related to the nature of the caregiving relationship, provision of better counseling services, recognition of competencies of persons with aphasia, and to achieve meaningful and effective therapeutic outcomes. Reliable information on social circumstances is crucial to assure successful rehabilitation beyond acute care as more individuals with high dependency are living in the community.

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#### G.P. CRUCIAN, P.S. FOSTER, D.W. BURKS, S.J. ARHMAGHANI, A. ARHMAGHANI, B. SKOBLAR, V. DRAGO, B. CROSSON & K.M. HEILMAN. Associational Strength Influences Response Latency in Single-Word Association.

**Objective:** Connectionist theories of semantic processing postulate once a node is activated, activation spreads to interconnected nodes within a conceptual network. Nodes that are more strongly connected are more readily activated following this stimulation. However, support for this premise has been inconsistent, in part, because of difficulties in quantifying conceptual association strength. We postulated that word association set-size could influence conceptual associational strength, with smaller set-sizes being more focused and thus having stronger associational strengths. Based on this postulate, we predicted that, after controlling for frequency and concreteness, words with smaller associational set-sizes would result in shorter response latencies during single-word generation than words with larger associational set-sizes.

**Participants and Methods:** Wordlists comprising 3 different associational set-sizes were compiled and administered in a single-word gen-

eration task. Set-size was operationally defined by the number of words (2, 6, 10) that account for 80% of responses using established single-word-association norms. Baseline control task involved single-word repetition. Responses from 22 healthy older adults were recorded and response latencies were quantified digitally.

**Results:** Repeated measures ANOVA revealed that small set-size was significantly faster than medium set-size, and both small and medium set-size were significantly faster than large set-size. No correlations with frequency or concreteness were found.

**Conclusions:** Words that activate large networks have overall weaker associations than words that activate a smaller, more focused network, and these differences in associational strength are related to differences in response latency in single word generation. Future studies might be directed at learning how disease induced degradation of semantic networks influence different set-sized networks.

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#### K.M. FITZGERALD, M. HISCOCK & A. WINGFIELD. Perseverative Errors as a Function of Age, Hearing Ability, and Contextual Constraint.

**Objective:** An auditory word-recognition task was administered to normal adults across various levels of age and hearing ability to determine if there was a difference in the number and types of errors made in word recognition as a function of the amount of constraining context provided.

**Participants and Methods:** Twenty younger adults with normal hearing (mean age = 22.8), 20 older adults with normal hearing (mean age = 74.1), and 19 older adults with impaired hearing (mean age = 78.9) performed a word-recognition task that was based on a sentence-completion paradigm. Sentences varied in amount of constraining context that they provided. The dependent variables were (1) the total number of initial-sound perseverative errors and (2) the proportion of total errors made that were initial-sound perseverative errors.

**Results:** Irrespective of dependent variable, Group x Level of Constraining Context analyses of variance (ANOVAs) yielded significant main effects for both context,  $p < .01$ , and group,  $p < .05$ . In addition, for the total number of perseverative errors, a significant interaction was found,  $p < .05$ . This interaction indicated that contextual constraint had a stronger effect on both older groups than on the young group. Although the interaction was nonsignificant in the analysis of the proportion of perseverative errors, pairwise comparisons indicated that young and older groups differed significantly at lower levels of contextual constraint.

**Conclusions:** The number of perseverative errors for initial sounds of words is directly related to age and inversely related to degree of contextual constraint, even when the greater error production by older individuals is controlled for. While older individuals tend to make a greater percentage of perseverative errors, higher levels of context served to equalize the performance of the different age groups.

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#### J. NYUGEN, T.D. GEFEN & R.B. FRIEDMAN. Enhancing Top-Down Processing to Remediate Hemianopic Alexia.

**Objective:** Hemianopic alexia (HA) is a reading disorder generally characterized by a loss of the right visual field. Aspects of the reading impairment in patients with HA include longer fixation durations, as well as more between-word regressive saccades, within-word forward and backward refixations, and abnormal initial landing positions (ILPs). As the lesion resulting in HA is in the left posterior occipital lobe, it is presumed that these impairments result from compromised bottom-up [perceptual] processing. Improving the efficiency of top-down influences on these processes may improve the reading of patients with HA. Our treatment was designed to enhance top-down [attentional] processing through repeated sentence reading.

**Participants and Methods:** NHL is a 65 year-old HA patient whose stroke occurred 4.5 years prior to testing. Training consisted of silently reading a set of sentences presented repeatedly. Eye movements were measured during testing sessions. In all sessions, comprehension questions were asked on random trials to ensure NHL's focus.

**Results:** Training significantly decreased the average fixation duration ( $p < .01$ ), the number of between-word regressive saccades ( $p < .05$ ) and the number of forward within-word refixations ( $p < .05$ ), resulting in an increase of the reading rate from 110 words-per-minute to 161 words-per-minute in trained sentences ( $p < .0001$ ). However, training did not affect ILPs or the number of backward within-word refixations.

**Conclusions:** A treatment that enhances top-down processing can improve the reading of patients with HA whose reading deficit is caused by impaired bottom-up processing.

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#### J. LAURES-GORE, R. SHISLER MARSHALL & E. VERNER. Forward and Backward Digit Span in Aphasia.

**Objective:** Numerous theories exist regarding the theoretical and physiological structure of working memory. Despite the unique variations of each theory of working memory, they all implicate a maintenance and processing component that act together during language processing. Thus, in individuals with aphasia (IWA), deficits in the working memory system may contribute to language processing difficulties. Digit span tasks, comprised of forward and backward tasks, have been used extensively to examine working memory capacity in IWA. The purpose of the current study is to further explore working memory skills in IWA by comparing their performance on forward and backward digit span tasks to individuals with right hemisphere stroke without aphasia (RH).

**Participants and Methods:** Thirteen IWA and thirteen RH completed a forward digit span task and a backward digit span task. Eight levels of 7 sequences of digits were orally presented to each participant. Participants were asked to point to the correct order of digits on a written 1-9 digit list or verbally repeat the numbers if the participant was able to do so. Span was defined as the maximum level at which 3 sequences out of 7 were accurate. The backward digit span task followed a similar procedure.

**Results:** Results indicate that IWA perform worse on forward digit span tasks than do the comparison group, yet perform comparably in backward digit span to RH.

**Conclusions:** It is questionable whether Digits Backward is indeed a clinically sensitive measure of working memory in IWA. Further discussion will focus on the clinical and theoretical implications of these findings.

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#### K. LEDOUX, T.D. VANNORS DALL, E. PICKETT, S.C. FIELDSTONE, D.J. SCHRETLEN & B. GORDON. Development, Reliability, and Construct Validity of a New Approach to Analyzing Qualitative Aspects of Speeded Lexical Retrieval.

**Objective:** We sought to capture additional qualitative aspects of lexical retrieval by expanding guidelines developed by Troyer and colleagues (1997) to assess within-category clusters and between-category switches on verbal fluency tasks. Our coding scheme was designed to capture additional associative relationships between successively-produced words. We assessed inter-rater reliability using intraclass correlation (ICC) to determine whether these guidelines could be implemented as consistently as those devised by Troyer et al. Finally, we examined the correlation of the ratings with demographic variables and neurocognitive test performance.

**Participants and Methods:** The productions of 13 healthy adults on letter (S and P) and semantic (animals and supermarket items) fluency tasks (one-minute duration) were scored by four raters using guidelines provided by Troyer and colleagues (1997) and those developed by our group. Each participant also completed a battery of other neurocognitive tests.

**Results:** We calculated ICCs for five measures derived from each scoring system: total correct words, number of clusters, number of switches, total cluster size, and mean cluster size. Raters consistently applied both sets of guidelines (all ICCs  $> 0.89$ ). We also developed two measures (runs and total run size) that are unique to our scoring system. These yielded ICCs  $> 0.85$ . Correlations between verbal fluency measures and selected demographic and neurocognitive variables were generally of similar magnitude.

**Conclusions:** Raters can reliably implement a fluency scoring system that includes expanded phonemic, semantic, and associative guidelines. This new scoring system may better reflect the organization of lexical entries in semantic memory and better capture participant-generated strategies for accessing these representations.

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#### A.B. MOORE, C.X. SHI, C.E. TYNER, A. GUTHERIE, L. BEACHAM, P. SEELY & K. MCCLELLAN. Manipulations of Visual Parameters and Lexical-Semantic Information on Object Naming.

**Objective:** This study systematically investigates the impact of semantic enrichment on naming of visually degraded stimuli.

**Participants and Methods:** 150 line drawings were manipulated across 6 levels of contrast (0.63, 1.25, 2.5, 5, 10, & 20%) and 6 levels of spatial frequency (0.25-0.5; 0.5-1; 1-2; 2-4; 4-8; 8-16 c/deg). Accuracy and latency to name the drawings were recorded for 23 neurologically normal adults (mean age 67). All subjects had intact vision. Prior to presentation of the target, half of the participants were given the super ordinate category to which the target belonged; the other half were not given clues.

**Results:** For the visually altered and the semantically enriched conditions, mean differences in naming (accuracy and latency) between the 6 experimental levels of visual manipulations and the control level were examined via 2 one-way analyses of variance. For stimuli administered without semantic cueing, latency and accuracy at contrast levels  $\geq 2.5\%$  did not differ significantly from performance on unaltered images; performance declined below that level. Similarly, accuracy was invariant at spatial frequency levels  $> 1$  c/deg but suffered below that level. Latency data indicated that subjects were slower to name objects containing only the lowest or highest spatial frequencies compared to the intermediate frequencies. Of note, addition of semantic cues had a paradoxical effect for contrast manipulated images. That is, compared to uncued images, addition of semantic information served both to reduce accuracy and increase latency to name objects with diminished contrast. The opposite was found for spatial frequency manipulations.

**Conclusions:** Both top-down and bottom-up processing impact object naming accuracy. The interaction between these processes is complex; semantic enrichment may not be uniformly helpful for naming. Our lab is examining this process in MCI and dementia because anomia is characteristic of dementia, as are changes in basic visual-perceptual functions (i.e., contrast sensitivity).

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#### L. MURRAY & J. HARVEY. A Comparison of Two Writing Treatments for Severe Anomia.

**Objective:** The purpose of this study was to examine the effectiveness and generalization potential of two writing treatments for severe anomia,

a Semantic Treatment (ST) and a Context/Story Treatment (CT), in an individual with chronic, severe global aphasia and apraxia of speech. Both treatments involved reviewing the semantic features of target words, but differed in the format of that review: ST involved a sentence completion task and CT involved a story completion task.

**Participants and Methods:** A multiple baseline, within-participant single-subject design was used to compare the two treatments. Picture stimuli representing target words from four semantic categories were divided into the following sets: (a) trained ST and trained CT, (b) untrained ST and untrained CT, and (c) control. Written and spoken naming of the pictures was probed, with some items from each set receiving a dynamic probe (i.e., scrambled anagram cueing hierarchy provided) to capture subtle changes that are often more typical in severe aphasia.

**Results:** Both treatments evoked improvements in written naming accuracy and speed, with more substantial improvements observed during CT. Error analysis indicated qualitative improvements may have occurred in the participant's orthographic processing system, as his written output showed an increase in related errors and decrease in unrelated errors throughout the duration of the two treatments. Cross-modal generalization to spoken naming and discourse was also observed, despite nominal change in written discourse.

**Conclusions:** Both ST and CT may enhance recovery from severe anomia, and our findings suggest that context may be an influential treatment variable for at least some individuals with severe anomia.

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#### C. NAKANISHI, T. HASHIMOTO & K. SEKI. The role of the left temporal lobe in learning Kanji characters.

**Objective:** The involvement of the left temporal lobe in learning Kanji characters has not been well established. The aim of this research was to clarify that the left temporal lobe is crucial in learning Kanji. We have assessed Kanji difficulties in a child with the left temporal lobe lesions.

**Participants and Methods:** A 8-year-old, right-handed boy was surgically treated for the left temporal lobe arteriovenous malformation (AVM) and the hematoma due to AVM. His lesion was located in the left temporal lobe. He was evaluated with standardized measures and special tests to assess Kanji difficulties at 12-year-old. To confirm this assessment, experimental learning was done under a single-case-design (ABA).

**Results:** The patient displayed difficulties only with Kanji. He was classified as having surface dyslexia and had difficulties in learning Kanji orthographic features. His recognition of individual radicals was correct, but he made many errors when radicals were combined in a character. These data suggested that his main problem was learning various radical combinations. Experimental learning showed that the efficient usage of radical information was significantly better than the standard learning method ( $p < 0.0001$ ).

**Conclusions:** Though many cases of adult Kanji disorders have been documented, this could be the first case that demonstrated the relationship between Kanji learning difficulties and the left temporal lobe lesions. Correspondence: *Chiyomi Nakanishi, Kobe University, 078-796-0263, Kobe city 651-2102, Japan. E-mail: chiyoumi.naka@nifty.com*

#### A.C. OGBURN & S.S. RUBIN. Lexical and Environmental Processing and Recovery Patterns in Aphasia: A Pilot Study.

**Objective:** Researchers have found evidence for a rightward shift of language in individuals with aphasia using dichotic listening tasks, PET and fMRI (Gold & Kertesz, 2000). If this finding is accurate, what effect might this have on right hemisphere functions? The purpose of the study was to determine whether language processing shifts to the right hemisphere, and what impact it would have on recognition of environmental sounds.

**Participants and Methods:** Three groups were examined with five participants in each group: 1.) aphasia, 2.) right hemisphere disorder, and 3.) control. Each group underwent lexical and environmental conditions in a dichotic listening task.

**Results:** Results indicated controls demonstrated ear symmetry in both conditions, which was unexpected as language is a left hemisphere task and environmental processing is a right hemisphere task (Pimental & Kingsbury, 1994). The RHD group demonstrated a strong REA (31%) in the lexical condition and an REA (13%) in the environmental, which suggests reliance on the intact left hemisphere. The aphasic group displayed an REA (2%) in the lexical, and an REA (7%) in the environmental. Further inspection revealed differences in processing styles based on aphasia type wherein conduction aphasics demonstrated a shift as evidenced by an LEA (13%) in the lexical condition, whereas anomic aphasics did not, which was indicated by the REA (11%).

**Conclusions:** Based on these findings, it appears that anomic aphasics relied on left hemisphere processing centers for linguistic and non-linguistic processing; the conduction aphasics demonstrated shifts of language processing to the right hemisphere and changes in non-linguistic processing.

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#### C.E. SANCHEZ, C.W. ROBERTS & J. SCHATZ. Language Dysfunction as an Indicator of Underlying Neurological Complications in Pediatric Sickle Cell Anemia.

**Objective:** Children with Sickle Cell Anemia (SCA) are at increased risk of stroke and other neurological complications. Examination with Transcranial Doppler (TCD) is part of routine clinical care in this population, as it reliably predicts risk of overt stroke. The aim of this study was to investigate the effect of increased cerebral blood flow velocities, as measured by TCD, on specific language abilities in a clinical sample of children with SCA.

**Participants and Methods:** Thirty-nine children ages 5 to 8 years old with SCA underwent TCD examination. Semantic, syntactical and phonological ability were tested using the Test of Language Development, Primary 3rd Edition (TOLD-P:3). Testing occurred as part of a routine clinical visit to the hematologist.

**Results:** TCD velocities predicted scores on tests of syntactical skills, even when accounting for age and preterm birth. Phonological processing exhibited a modest relationship with TCD velocities and semantic ability showed little relationship.

**Conclusions:** The cause of the deficit in syntax ability as related to elevated velocities may be related to a specific language dysfunction or to a broader dysfunction of the processes underlying syntax. This study underscores the need of clinicians to monitor language skills of children with SCA, as this cognitive ability might be the first sign of underlying neurological complications related to their disease.

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#### L.A. SCHAEFER, L.H. PICK, R. CRUZ, A. NWACHUKU, R. TRANCCO-EVANS & L. WEISS. A Case Of Acute Crossed Conduction Aphasia Superimposed On Vascular Dementia.

**Objective:** Studies have demonstrated neuropsychological deficits other than linguistic in crossed conduction aphasia. These cases, however, resulted from single focal lesions. We present the neuropsychological profile of a dextral status-post right CVA, with language deficits meeting the criteria for crossed conduction aphasia. Additionally, neuroradiological results suggest pre-existing underlying neurodegenerative pathology.

**Participants and Methods:** The patient is an 85-year-old male electrical engineer who suffered a right temporal CVA with resultant left-sided weakness and sudden onset of unintelligible, although fluent, speech. According to family report, he had also exhibited progressive forgetfulness during the previous year. MRI revealed acute infarction of the right temporal lobe, as well as left parietal cortical laminar necrosis. CT showed bilateral parietal encephalomalacia and mild periventricular ischemic-gliotic changes. The patient underwent a comprehensive neuropsychological evaluation one week after the CVA.

**Results:** Spontaneous speech was fluent. However, neologisms, phonemic paraphasias, and word-finding difficulties were noted. Repetition for simple and complex words was impaired. Confrontation naming was also impaired. Comprehension, by contrast, was unimpaired. Reading comprehension was similarly intact, but oral reading was difficult. Writing was the patient's primary mode of communication, and he was able to copy words and write both spontaneously and to dictation. Cognitively, he showed deficits in complex visual attention, visuo-perceptual functioning, and visual memory. These deficits have been documented with previously reported crossed aphasia, consistent with non-dominant hemisphere impairment. Further, mild acalculia, apraxia, and executive dysfunction were present.

**Conclusions:** This case raises the question of evaluative and diagnostic practice when assessing individuals with both chronic neuropathology and overlapping acute lesions.

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**P.W. SEELY, C.E. TYNER, K. MCCLELLAN & A.B. MOORE. The Wisdom of Age, the Spice of Youth. What is SAGE?**

**Objective:** The goal of the study is to provide current normative data for word meanings of homographs, with an emphasis on differences in word associations due to age and sex.

**Participants and Methods:** Dominant word meaning was assessed using two internet survey methodologies previously described by our lab (a restricted access program designed for use in undergraduate psychology classes and a public, easy-to-access survey program). Participants were shown a target word (i.e., bank), and asked to select the dominant word meaning or association from among 2 choices (i.e., river/money). Data from 159 neurologically normal participants are reported; 99 additional participants completed the survey but elected not to provide demographic data and so were not included in these analyses. We tested for differences between younger (18 – 22 years) and older (51 – 83 years) participants as well as for differences between men and women. Analyses for age differences are based on ratings of 425 words. The analyses for sex differences are based on 507 words.

**Results:** Polarization indices reflecting percent of respondents selecting word meaning A vs word meaning B were tabulated. This allowed comparisons for younger vs. older participants and for men vs. women. Overall, men and women had concordant responses for 44% of the words with discordant responses for the remaining 56%. Younger and older adults had concordant responses for 18% with 82% discordant. Our data suggest that while there are some sex differences in terms of associations for dominant word meanings, there is a clear effect of age.

**Conclusions:** These findings highlight the importance of attention to variables such as age and sex when engaging in studies of language function. We intend these findings to assist others working with homographs to better understand word priming, semantic processing, and controlled vs. automatic processing of language.

The poster will provide handouts with the complete list of stimuli with concordance and discordance highlighted.

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**M.M. SMITH, P.A. ARNETT, F.H. BARWICK & B.P. AHLSTROM. Dysarthria and Speeded Cognitive Tasks in MS: Replication and Examination of the Validity of Examiner Ratings.**

**Objective:** Many cognitive tests recommended for multiple sclerosis (MS) populations require a rapid spoken response. We have previously shown that MS patients demonstrate slowed oral motor speed relative to controls, which affects performance on tasks requiring a speeded oral response. This study replicates these findings and examines the relationship between examiner-rated dysarthria and a performance measure of oral motor speed.

**Participants and Methods:** 51 MS patients and 50 controls completed the PASAT, COWAT, Animal Naming, Oral SDMT, and a measure of rudimentary oral motor speed, the maximum repetition rate of syllables and multisyllabic combinations task (MRR). Examiners rated participants' level of dysarthria on a four-point scale prior to test administration.

**Results:** Examiner ratings significantly correlated with MRR performance. Participants rated by examiners as dysarthric performed approximately one standard deviation below those rated as normal. In regression analyses, the amount of variance in cognitive test raw scores accounted for by the group (MS-Control) variable was reduced by the following amounts when the examiner rating was entered first: PASAT: 6% to 3%, COWAT: 7% to 2%, Animal Naming: 9% to 3%, and SDMT: 10% to 5%. The group effect was no longer significant for PASAT and COWAT when entered after the examiner rating.

**Conclusions:** Replicating our previous findings, examiner-rated dysarthria significantly contributed to group differences on cognitive test performance. Furthermore, results were similar to those obtained using the MRR task, suggesting that examiner ratings are a simple and valid measure of rudimentary oral motor speed.

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**G.A. STEFANATOS, A. DEMARCO, R. SEGAL, A. GERSHKOFF & Y. IEUJI. Dextroamphetamine improves attention to speech in aphasia.**

**Objective:** Recent open-label trials and double-blind placebo-controlled neuropharmacologic studies have suggested that the outcome of speech/language therapy for aphasia can be enhanced with adjuvant treatment using low doses of dextroamphetamine (D-AMPH). The nature and physiological basis of this facilitatory effect remains to be specified. Given D-AMPH's effects on dopaminergic and noradrenergic neurotransmission, we investigated the effects of D-AMPH on auditory attention in aphasia. The primary variable was an event-related potential (ERP) component (P3b) which indexes attention processes and updating of information in working memory.

**Participants and Methods:** Using a placebo-controlled, double-blind crossover design, we compared a 20 mg single dose of D-AMPH to placebo in 10 participants with Broca's or Anomic aphasia. ERP's were recorded while patients were engaged in 3 oddball target detection tasks each using a different stimulus type – complex tones (CT), vowels (V) and consonant-vowels (CV).

**Results:** In comparison to placebo, D-AMPH produced an overall increase in P3b amplitude in all stimulus conditions. However, the effect was most prominent in the CV condition. Although evident at frontal sites, increases were largest in central and parietal electrodes. N1, P2, and N2 latency and amplitude did not differ between treatment conditions.

**Conclusions:** D-AMPH improved auditory attention in subjects with aphasia. The effect was larger for speech (CV) than to non-speech sounds (CT) and was evident in recordings from both hemispheres. These effects on attention may be mediated by D-AMPH's influence on neural network synchrony, which is critical to learning and relearning. Amelioration of these and related functions may facilitate experience-mediated neuroplasticity.

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**Z.Z. ZLATAR, I. LEVY, M. BENJAMIN, K. MCGREGOR, M. COHEN, J. TRINASTIC & B. CROSSON. Lesion Severity Predicting Right-hemisphere Homologous Activity and Treatment Improvement in Non-fluent Aphasia.**

**Objective:** Much remains to be known about the predictive value of degree of lesion on reorganization of language function and treatment improvement in aphasia. Previous studies suggested that if a lesion is present in a left-perisylvian area, language function may reorganize to

its right-hemisphere homologue (Blank, 2003). The first aim of this study was to investigate the relationship between degree of lesion in left-perisylvian regions (on a scale of 0-5) and amount of functional activity in homologous right-hemisphere structures during fMRI. The second aim was to study whether left-perisylvian lesion severity predicted treatment gains.

**Participants and Methods:** Fourteen nonfluent aphasia patients (Mean age=66.21, SD=13.44) received structural and functional MRI prior to an intention-based language treatment. During fMRI, subjects performed an event-related category member generation task; functional images were not usable in three patients. We studied two broad regions of interest (ROIs): Anterior (BA 44,45) and Posterior (BA 39,40,21,22) perisylvian areas. We hypothesized that higher lesion scores in the left hemisphere ROIs would predict higher brain activity in right-hemisphere homologues and poorer treatment gains.

**Results:** We found no relationship between pre-treatment lesion severity and amount of activity in the right-hemisphere homologues of the two ROIs. Results also indicated that patients with more severe left posterior lesions showed less improvement during treatment.

**Conclusions:** This study did not confirm Blank's findings as a generalizable principle and provided much needed information regarding the ability to predict treatment performance based on lesion severity. The implications and utility of these findings will be discussed.

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## Other

### **K. LE, R. BUCK, C. COELHO, J. MOZEIKO & J. GRAFMAN. The Effect of Penetrating Head Injury on Symbolic and Spontaneous Communication.**

**Objective:** One of the hallmarks of traumatic brain injury (TBI) is impaired social communication. TBI can disrupt symbolic and spontaneous communication, both critical for social functioning. Few studies have examined symbolic/verbal and spontaneous/emotional communication in tandem. This study examined relationships between measures of narrative discourse and emotional communication in a subset of the TBI population—penetrating head injury (PHI).

**Participants and Methods:** Participants included 28 individuals with right PHI, 22 with left PHI, and 46 non-brain-injured control participants. Discourse production was assessed using organizational and content measures. Discourse comprehension was evaluated using the Discourse Comprehension Test. Emotional communication was examined with The Facial Expressions of Emotion Test and the Mayer-Salovey-Caruso Emotional Intelligence Test.

**Results:** A MANOVA indicated significant group differences across measures. Post-hoc tests revealed significant differences between brain-injured and control groups but no differences between right and left PHI groups. However, differing patterns of relationships between measures emerged in correlational analyses. The left PHI group demonstrated significant robust correlations between discourse measures, between emotion measures, and between discourse and emotion measures. Fewer correlations were observed in the non-brain-injured group, and significant correlations were not as robust as the left PHI group. In the right PHI group, correlations were only significant between emotion measures.

**Conclusions:** The results confirm that verbal and emotional communication changes following PHI. Further, the results suggest that PHI differentially alters the relationship between various communication skills depending on site of damage. Left PHI appears to strengthen the relationship between and across verbal and emotional communication measures while right PHI appears to dissociate the relationships.

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## Visuospatial Functions/Neglect/Agnosia

### **P. CHEN, K. LORANTIN, J. DELUCA & A.M. BARRETT. Visuospatial memory training for right hemisphere stroke.**

**Objective:** After a right hemisphere stroke, visuospatial abnormalities may occur, impairing survivors in encoding and retrieving spatial-distributed information in a global-to-local fashion, even with intact visual sensory function. Their subjective mental experience of the visuospatial world, and frustration of failures in visuospatial representation and recollection, is difficult to imagine. A visuospatial training that emphasizes global-to-local processing may improve their impairment.

**Participants and Methods:** We worked with three survivors who did not meet criteria for spatial neglect but had significant visuospatial deficits: JW (female, 58yr), RS (female, 76yr), and IL (male, 77yr). All three demonstrated difficulties in immediate recall of the Rey-Osterrieth complex figures (ROCF). Using ROCF as the training material that forced global-to-local visuospatial processing (see Diamond et al., 1997, Brain, 120), we observed the following.

**Results:** Two survivors significantly improved in organizational strategy (JW:  $r = .82$ ,  $p = .046$ ; IL:  $r = .92$ ,  $p = .010$ ) and recall accuracy (JW:  $r = .91$ ,  $p = .011$ ; IL:  $r = .97$ ,  $p = .001$ ) on successive immediate recall assessments. One participant, RS, showed less ROCF training benefit over time (organization:  $r = .77$ ,  $p = .075$ ; accuracy:  $r = .67$ ,  $p = .149$ ). She was also impaired in both working memory (i.e., forward and backward digit span) and verbal memory, while JW and IL performed normally on those tasks.

**Conclusions:** These preliminary results suggest that right hemisphere stroke survivors may benefit from the global-to-local visuospatial training if working and verbal memories are unaffected. Our work supports a need for more emphasis on specific rehabilitation for visuospatial memory deficits in cognitive rehabilitation.

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### **R.B. PERNA & A. JACKSON. Ecological Validity: Rey Complex Figure Test and Independent Living Skills.**

**Objective:** Many neuropsychological measures have questionable ecological validity though the purpose of testing is often to provide opinions regarding a persons independent living skills. The purpose of this study was to administer measures of independent living skills with the ROCF copy trial and assess its ability to predict living skills, adaptability, and level of functioning with regard to work, living situation, and money management.

**Participants and Methods:** ABI participants (N=71) with a mean age of 38.6, mean education = 11.9 years, involved in a neurorehabilitation program completed the Rey Complex Figure Test (ROCF) copy, and the Mayo Portland Adaptability Inventory-4 (MPAI). The MPAI has 3 subscales (Ability, Community Participation, Psychosocial adjustment), and demographic items concerning residential status (levels 0-4), Employment status (levels 0-4), transportation use (levels 0-4), & ability to manage finances (levels 0-4).

**Results:** The ROCF copy correlated ( $p < .01$ ) with all three MPAI subscales [Ability ( $r = .61$ ), Adjustment ( $r = .66$ ), Participation ( $r = .57$ )], and the demographic variables residence ( $r = -.45$ ), work status ( $r = -.30$ ). ANOVA analyses found that different residential, employment, and money management levels had statistically significant different ROCF copy scores. Post hoc testing showed higher scores corresponded to increased independence.

**Conclusions:** The ROCF correlated significantly with many real life outcomes including adaptability and degree of independence in living circumstances, and employment status. Specifically, individuals who scored higher on the ROCF were significantly more likely to live independently, be independent with transportation, and work.

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**Y. NAKAGAWA, S. NAKADOMARI, J. KAWACHI, K. KITAHARA & T. MOCHIZUKI.** Selective impairment of shape recognition defined by color and binocular disparity caused by bilateral ventro-medial occipital lesions.

**Objective:** We investigated impaired shape recognition defined by various features in three patients with bilateral infarction in the ventro-medial occipital lobe and suggested the functional specialization due to the common lesion.

**Participants and Methods:** There were three male patients with bilateral occipital lobe damage due to infarction. Mean age was 59.0 years. The corrected visual acuity for both eyes were above 0.7. We used the standard neuropsychological tests to evaluate their general intelligence and memory. We also administered various perceptual tests to evaluate basic visual functions, and then tested more specifically for visual agnosia and for the recognition of visual shapes defined by color, binocular disparity, luminance, texture or motion.

**Results:** They showed normal verbal IQ's and severe deterioration in Performance IQ and memory. According to the visual tests, all patients had normal scores on the Farnsworth dichotomous test panel D-15, however they could not detect numbers in Ishihara pseudoisochromatic plates at the onset of the disorder. Moreover, they could detect a stereoscopic image defined by binocular disparity, but none was able to recognize shapes defined by binocular disparity in random-dot patterns. Despite impaired shape recognition defined by color and binocular disparity, they were able to recognize shape from luminance or texture information.

**Conclusions:** The evidence that all three patients suffered from prosopagnosia and two showed no abnormalities in lateral surface of occipital lobe, suggested injury to the bilateral ventro-medial occipital lobe, especially the fusiform gyrus, appears to cause deficits in shape recognition defined by color and binocular disparity.

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**K.S. WALSH, P.J. DUQUETTE, C. KORANSKY & G.A. GIOIA.** Contribution of Attention and Executive Function in the Presentation of Visuospatial Deficit in Children with NF-1.

**Objective:** Neuropsychological impairments are among the most common sequelae for children with NF-1, most notably visuospatial, attention, and executive function deficits. Upwards of 50% of children with NF-1 exhibit regulatory control deficits. This study examines the relative contributions of visuospatial versus attention/executive dysfunction on error patterns on the Judgment of Line Orientation (JLO) in children with NF-1. Establishing the psychometric properties and utility of a novel scoring system for the JLO was also an objective.

**Participants and Methods:** Nineteen patients involved in one of several prospective or retrospective NF-1 studies participated. All participants underwent extensive neuropsychological assessments from which the data for this study was extracted. Participants were categorized based on quantitative attentional deficits (TEA-Ch, Sky Search DT), generating two groups – NF1 with (NF1+AD) and without (NF1-AD) attention deficits. Group performance was compared on an expanded scoring system of the JLO that extended the score range by assigning credit for each response, as well as establishing error scores based on difficulty level and item location in the test.

**Results:** After controlling for IQ and visuomotor function, a significant difference in error patterns was identified between the NF1-AD and NF1+AD groups such that the latter exhibited significantly more errors on items requiring greater vigilance and time to differentiate, including higher difficulty items and those in the last third of the test.

**Conclusions:** These findings highlight the possible importance of attention-related factors on a classic test of visuospatial ability in those children with poor regulatory control. A novel scoring system with more sensitivity and specificity is presented.

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**P. ZUFFANTE & K.M. HEILMAN.** Developmental Number-Symbol Visual-Tactile Agnosia.

**Objective:** Visual recognition deficits (agnosia) can be a major cause of disability. Studies of patients with brain lesions suggest that agnosia can be categorically specific. With the exception of prosopagnosia, there are very few reports of developmental visual agnosia in children and the purpose of this report is to describe a girl who had a relatively specific form of visual agnosia.

**Participants and Methods:** Case Report

**Results:** A 6 1/2 year old girl (AL) demonstrates a relatively selective and severe impairment in visual and tactile number recognition. Brain imaging revealed no pathological condition that could account for this disorder, suggesting a developmental deficit. The impairment extends to other forms of symbolic information such as letters, shapes and colors, but these deficits were not the same severity as the impaired number recognition. AL shows the ability to access numerical knowledge and reason numerically when the format of input and output is auditory/verbal. Picture naming was normal and an extensive cognitive evaluation was unremarkable except that performances on measures of visual perceptual processing were variable and generally weaker than her performance on measures of language; however, AL was able to copy and match numbers easily.

**Conclusions:** The cause of this symbol-specific form of visual-tactile agnosia is not known. However, information processing models of object agnosia suggest that there are object recognition units (representations of previously seen objects) and perhaps this patient had a failure to develop symbol recognition units which are independent from the object units.

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#### Birch Lecture:

### The Goldilocks Dilemma In Neurodevelopmental Disorders: A Functional Brain That Is Not Too Big, Not Too Small, But Just Right

Speaker: Maureen Dennis

4:45–5:45 p.m.

**M. DENNIS.** Birch Lecture The Goldilocks Dilemma In Neurodevelopmental Disorders: A Functional Brain That Is Not Too Big, Not Too Small, But Just Right.

Childhood or adult brain insults acquired after a period of normal brain development typically involve regional loss or damage in the brain, with loss or damage being associated with poorer neurocognitive function. In neurodevelopmental disorders, in contrast, the brain is afforded no period of normal development, but instead undergoes a complex reorganization during the process of development. Part of this reorganization involves a reduction (in overall brain size, in regional thickness, or in white matter tract connectivity). Less studied in neurodevelopmental disorders are those aspects of brain reorganization that involve increases (in overall brain size, in regional thickness, or in the volume of some commissures) or additions (of aberrant tracts). What I have termed The Goldilocks Dilemma in neurodevelopmental disorders is the brain's task of calibrating the relation between brain size and neurocognitive functionality, so that the developmental reorganization is one that optimizes function. Using as an example the neurodevelopmental disorder, spina bifida, this presentation: Reviews some features of brain reorganization (pathological size decreases, pathological size increases, and aberrant tracts); considers the existing evidence for enhanced or attenuated functionality of each feature; and speculates about some characteristics of a 'Just Right' brain in this neurodevelopmental disorder.

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FRIDAY MORNING, FEBRUARY 13, 2009

### Symposium 7: The Nature of Neurobehavioral Impairments in Children Born Very Preterm.

Chair: Peter Anderson

Discussant: H. Gerry Taylor

9:00–10:30 a.m.

P.J. ANDERSON, H.G. TAYLOR, P.J. ANDERSON, I. BARON, L.J. WOODWARD, D. DEWEY, C. NOSARTI & K. ESPY. **The Nature of Neurobehavioral Impairments in Children Born Very Preterm.**

**Symposium Description:** Approximately 1-2% of live births are very preterm (<32 weeks' gestation), and with advances in medical care the majority of these infants now survive (> 85%). In contrast, morbidity rates have not improved with more than 50% of very preterm survivors experiencing later neurobehavioural impairments, and the societal economic burden associated with preterm birth is enormous (>US\$26 billion in the USA).

This symposium brings together experts in the field of prematurity from Australia, Canada, New Zealand, USA, and United Kingdom to explore the nature of the problems experienced by very preterm children in infancy, early childhood, and early adulthood. A number of new and novel approaches to assessment will be presented, with a particular focus on identifying specific cognitive and motor impairments at a young age. The early detection of impairments in this population is crucial for targeting high-risk children and referral to appropriate early intervention services.

Neuropathology and altered brain development are common in children born very preterm. This symposium will present findings that demonstrate that neonatal brain imaging can predict later cognitive difficulties and that functional imaging can help in understanding the neural networks associated with specific areas of impairment.

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P.J. ANDERSON, S. NGUYEN THE TICH, R. HUNT, L. DOYLE & T. INDER. **Brain Metrics at Term Equivalent Age Predicts Early Cognitive and Motor Development in Very Preterm Children.**

**Objective:** Volumetric techniques applied to cerebral magnetic resonance images (MRI) demonstrate reductions in brain volumes in very preterm infants and have been useful in defining the nature of altered brain structure. However, such techniques are not available in routine neonatal radiological care. An alternative technique for assessing brain size in the very preterm infant - brain metrics - has recently been reported.

**Objective –** To assess the relationship between specific brain metric measurements (bifrontal, biparietal and transverse cerebellar diameter) and early development in a large cohort of very preterm children.

**Participants and Methods:** Participants – 189 preterm infants (<30 weeks' gestation or <1250 g).

**Methods –** Infants had a MR brain scan at term equivalent age (40 +/- 2 weeks). Coronal T2W MR images were studied and using selected slices bifrontal diameter, biparietal diameter and transverse cerebellar diameter were measured. At two-years of age (corrected) children were administered the Bayley Scales of Infant Development (BSID-II).

**Results:** After adjusting for perinatal, neonatal, and social predictors, brain metric measurements were significantly associated with cognitive and motor development. Biparietal diameter was significantly associ-

ated with both cognitive ( $p < .02$ ) and motor ( $p < .05$ ) development for both genders. However, bifrontal diameter was significantly associated with cognitive and motor development ( $p < .05$ ) for boys only, and cerebellar diameter was significantly associated with cognitive and motor development ( $p < .05$ ) for girls only.

**Conclusions:** This study demonstrates that brain metric measurements are predictive of early cognitive and motor development. Furthermore, these findings suggest specific gender vulnerabilities.

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I. BARON, K. ERICKSON, A. FLETCHER, K. COULEHAN, M. IAMPIETRO, M. AHRONOVICH & F. LITMAN. **Neurobehavioral and Cognitive Outcomes of Extremely Preterm, Late Preterm, and Term Birth at Three-Years-Old: A Single Center Study.**

**Objective:** To compare the differential incidence of neurocognitive and behavioral problems in a single center cohort of extremely preterm, late preterm (34-36 weeks), and full term 3-year-old children, and examine those risk factors predictive of poor neurocognition and behavior.

**Participants and Methods:** Participants (N= 112) were born <1000 g (n = 41), at late preterm (LP; n =51) or at TERM (n = 20) in 2004-2005. Norm-referenced tests and parent questionnaires assessed general cognition, executive functions, verbal/nonverbal attention, language, memory, motor and visuomotor skill, and behavior.

**Results:** Participants born <1000 g had average but significantly poorer cognition than LP and TERM participants, poorer motor, fluency, and attention scores, and poorer reported working memory, social skills, functional communication, and adaptive skills. However, these "adverse" outcomes mostly fell within one standard deviation of the normative mean, suggesting a protracted developmental course consequent to preterm birth, rather than impairment. Mostly, LP and TERM were not significantly different.

**Conclusions:** Extremely preterm neuropsychological studies are rarely conducted before elementary school age, although significant neurocognitive compromise is likely. When conducted, these evaluations have generally been limited to broad cognitive and/or neuromotor measures. We administered a more detailed series of cognitive, neuropsychological (motor, attention, and executive), and behavioral tests at 3-years-old, and found emergent skill and behavioral weaknesses common to high-risk extremely preterm school-age children, and only minimal differences between later preterm and term participants. These data support routine neuropsychological evaluation prior to school entry, when targeted interventions may be most effective.

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K. ESPY, A. SCHUTTE & S. WIEBE. **Using Cognitive Science Tools to Elucidate Mechanisms of Inattention in Preschoolers Born Preterm.**

**Objective:** Children born preterm are at known risk for deficits in attention in school age and beyond, even those born at lower neurobiologic risk. With currently available standardized clinical instruments, it is difficult to identify inattention earlier in development, in the preschool period where systematic intervention could avert such developmental pathways.

**Objective –** To assess the feasibility and utility of a novel cognitive science paradigm in characterizing inattention in preschoolers born preterm.

**Participants and Methods:** Participants – 94 preschoolers (3 - 6 years of age), 28 of which were born preterm (PT; 28-36 weeks gestation).

**Methods –** Preschoolers were administered a child friendly (Bubble Burst, Spaceship Search) version of a spatial working memory task, where target location was distributed homogeneously across space. Working memory load was manipulated by varying delay length. Spatial Distractors also were included that varied in interference load (not present, closer or further from the target). Search site was recorded.

**Results:** There was no difference in task performance between PT and term groups without a distractor regardless of delay interval. PT preschoolers made significantly more errors with the distractors present compared to the term born group. Younger PT preschoolers made more spatially-biased searches than their term peers. Finally, when the distractor was far from the target, older PT preschoolers made more perseverative errors and returned to search at a previous location than did term controls.

**Conclusions:** Distractors have a greater influence on spatial working memory in preschoolers who were born preterm in comparison to term controls. Using this cognitive science paradigm with very young children is feasible and has promise as a tool to better elucidate inattention at a very young age in those at risk for later disturbances.

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#### **L.J. WOODWARD & T. INDER. Neonatal White Matter Abnormalities Predict Neurocognitive Outcome in Children Born Very Preterm.**

**Objective:** Cerebral white matter abnormalities detected on term MRI have been shown to be strongly predictive of severe neurodevelopmental impairment in children born very preterm (<33 weeks gestation). However, the contribution of these neuroanatomical findings to less severe, but clinically important, neurocognitive impairments remains unclear.

**Participants and Methods:** Using prospective longitudinal data from a cohort of 106 very preterm and 106 full term born children, this study examines associations between qualitative MRI measures of cerebral white matter abnormalities at term equivalent and neurocognitive outcome at age 4 years. At term equivalent, all preterm infants underwent a structural MRI scan that was analysed qualitatively for the presence and severity of cerebral white matter abnormalities, including cysts, signal abnormalities, loss of white matter volume, ventriculomegaly and corpus callosal thinning/myelination. At 4 years corrected age, all children underwent a comprehensive neurodevelopmental assessment that included standardized measures of intelligence, language ability and executive functioning.

**Results:** Results revealed that at age 4 years, very preterm children without cerebral white matter abnormalities showed no cognitive impairments relative to their full term peers on measures of intellectual ability, receptive language, expressive language and executive functioning ( $p > .40$ ). In contrast, children born very preterm with mild and moderate-severe white matter abnormalities were characterized by performance impairments across all measures, with more severe abnormalities being associated with increased impairment ( $p < .01$ ).

**Conclusions:** Study findings highlight the importance of cerebral connectivity for later intact cognitive functioning amongst children born very preterm.

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#### **D. DEWEY, D. CREIGHTON, J. HEATH, B. WILSON, D. ANSEEUW-DEEKS, S. CRAWFORD & R. SAUVE. Motor Impairment in Children with Birth Weight < 1000 g: Prevalence and Identification.**

**Objective:** To examine the prevalence of motor impairments in children born at < 1000 g and the effectiveness of various protocols in identifying motor impairments.

**Participants and Methods:** Design: Cross sectional sample  
Setting: Hospital-based follow-up clinic

Participants: 103 children aged 5 years with birth weight < 1000 g, mean gestational age 27.1 weeks, mean birth weight 817.3 g.

Interventions: Three assessment protocols to identify motor impairment: 1) the Clinic Protocol, (i.e., Geometric Design and Mazes subtests of the Wechsler Preschool and Primary Scale of Intelligence-Revised,

Fine and Gross Motor subscales Child Development Inventory, a pediatric neuromotor exam; 2) the Occupational Therapy Battery (i.e., Movement Assessment Battery for Children, Beery-Buktenica Developmental Test of Visual Motor Integration, Developmental Test of Visual Perception-2); 3) the Movement Assessment Battery for Children  
Outcome measures: Identification of motor impairment; sensitivity and specificity of various protocols.

**Results:** The Clinic Protocol identified 66%, the Movement Assessment Battery for Children identified 64% and the Occupational Therapy Battery identified 67% of the children as displaying motor impairment. The Clinic Protocol was sensitive to identifying children with motor problems when compared with the Occupational Therapy Battery and the Movement Assessment Battery for Children and agreement among the assessment protocols was fair.

**Conclusions:** Children with birth weights < 1000 g are at high risk for motor impairment. Failure to identify and address these motor impairments could have a significant impact on educational, physical and mental health outcomes. Therefore, assessment of motor functions is an essential component in developmental evaluations of these children.

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#### **C. NOSARTI, E. LAWRENCE, V. GIAMPIETRO, L. RIFKIN, R. MURRAY & P. MCGUIRE. The Impact of Very Preterm Birth on the Functional Neuronal Development of Episodic Memory in Adulthood.**

**Objective:** Few studies have explored the impact of very preterm birth (VPT) on functional neuronal development in adulthood.

**Participants and Methods:** We describe data from the first investigation which used a verbal paired-associate learning (VPAL) task administered within a functional magnetic resonance imaging (fMRI) paradigm in 20 years old individuals who were born VPT (<33 gestational weeks,  $n=22$ ) and age-matched controls ( $n=22$ ). The VPAL task included 4 conditions: encoding, cued-Recall, font discrimination and a low level baseline.

**Results:** Despite no differences in task performance, results showed that during encoding VPT participants compared to controls showed increased brain activation in the left parahippocampal (Brodmann Area, BA19) and precentral gyri (BA6). During Recall, VPT participants displayed increased activation in precentral gyrus (BA4) in contrast to controls. In addition, when encoding was contrasted with a font discrimination baseline condition, group differences (VPT > controls) were observed in the precentral gyrus (BA6) and left cerebellum (BA6).

**Conclusions:** In summary, this study suggests in the absence of differences in cognitive performance, VPT birth is associated with functional neuronal differences in adulthood during completion of an episodic memory task in brain areas where structural variations have been previously reported, specifically in the medial temporal lobe, which is known to subservise a variety of mnemonic processes.

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### **Invited Plenary: Aging of Cognition from 18 to 60**

**Speaker: Timothy Salthouse**

**9:00–10:00 a.m.**

#### **T. SALTHOUSE. Aging of Cognition from 18 to 60.**

It is often assumed that little age-related cognitive decline occurs prior to age 60 in healthy adults. A major theme of this talk is that this assumption is not correct, and that cognitive changes likely begin in the

20s and 30s for many normal adults. Results from cross-sectional and longitudinal research will be described, including analyses of cross-sectional comparisons after controlling for possible indicators of cohort status and analyses of longitudinal comparisons after controlling for estimates of retest effects. Although the causes of age-related cognitive differences are not yet well understood, quite a bit is known about what changes with increased age and when it changes.

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## Poster Session 6: Imaging, Cognitive Neuroscience, Behavioral Neurology

9:00–10:30 a.m.

### Behavioral Neurology

#### E. BALDWIN & J. WETHE. **Wernicke's Encephalopathy in a Non-Alcoholic Patient: Neuropsychological Features and Imaging Findings.**

**Objective:** Nutritional deficiency can have serious neurologic consequences. Wernicke's Encephalopathy (WE) is often associated with patients who have a history of alcohol abuse. However, it is also a rare and life-threatening condition that commonly occurs in the late stages of acute pancreatitis. The current study presents data from a woman with malabsorption secondary to acute pancreatitis for whom a diagnosis of WE had been made.

**Participants and Methods:** A 48-year-old woman with a 2-month history of memory decline and a diagnosis of WE. An MRI imaging study was conducted. The patient underwent a cognitive screening and a brief neuropsychological evaluation over the course of 1 month.

**Results:** MRI studies showed white matter signal changes in the pons and subcortical white matter hyperintensity in the frontal and parietal lobes consistent with advanced chronic microvascular ischemic disease. Results from the neuropsychological assessments revealed moderate to severe impairment in verbal and visuospatial memory. Verbal fluency, processing speed, and some aspects of executive functioning were also compromised.

**Conclusions:** Because WE is thought to be a disease that occurs primarily in the alcoholic population, clinicians may be less likely to recognize this condition in non-alcoholic patients. This case illustrates the serious cognitive consequences of a nutritional disorder in a patient without a history of alcohol abuse.

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#### E. BALDWIN & S. GALE. **Clinical Implications of Cerebellar Damage: A Case Study.**

**Objective:** There is growing evidence that lesions in the cerebellum can result in changes in behavior and cognition. According to the Cerebellar Cognitive Affective Syndrome, lesions involving the posterior lobe of the cerebellum and the vermis have been characterized by impairment of executive function, visual-spatial organization, and memory, personality change, and language deficits, whereas lesions of the anterior lobe have been characterized by minor changes in executive and visual-spatial functioning. The current study presents longitudinal data from a man who had a left cerebellar hemangioblastoma. Although he made recovery in cognitive and neurobehavioral deficits after the tumor was resected, he continued to experience behavioral and cognitive decline.

**Participants and Methods:** A 49-year-old male with a history of cerebellar hemangioblastoma. Imaging studies were conducted. The patient received a brief neuropsychological examination prior to his tumor resection as well as at 2 months and 9 months post resection.

**Results:** Results from the assessments revealed initial deficits in processing speed, memory, and executive function. The patient demonstrated improvement across most cognitive domains; however, there was evidence of persistent mild difficulty with executive function and fine motor dexterity. There was improvement in neurobehavioral symptoms (disinhibition, impulsivity, etc.) though he demonstrated other continued residual personality change.

**Conclusions:** Although the cognitive and neurobehavioral changes associated with a cerebellar hemangioblastoma may improve, executive and behavioral disturbance can persist with important functional consequences. This case illustrates the importance of long-term follow-up after cerebellar lesion.

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#### L.C. BUTTERFIELD, L.E. OELKE, C.R. CIMINO, R. HAUSER & J. SANCHEZ-RAMOS. **Apathy, Depression, and Cognitive Functioning in Parkinson's Disease.**

**Objective:** Several studies provide evidence to suggest that apathy and depression, two of the most common psychiatric symptoms in Parkinson's disease (PD), are independent clinical phenomena that may differentially affect cognition. Research suggests apathy may account for cognitive deficits, especially executive, over and above that of depression. However, few studies have examined this in PD patients using sensitive measures of specific cognitive domains and severity scales designed to provide greater discrimination between apathy, depression, and somatic symptoms of PD.

**Participants and Methods:** Sixty-eight patients with idiopathic PD completed self-rating measures of depression (BDI-II, select items) and apathy (AES-S), and tests of memory (HVLT-R) and executive functioning (WCST-64). Depression severity was assessed using items that do not overlap with apathy or with somatic symptoms of PD. Data was analyzed using correlation and hierarchical regression.

**Results:** Apathy, but not depression, was significantly correlated with executive functioning. In contrast, immediate memory was significantly associated with both apathy and depression. However, regression analyses revealed apathy accounted for added variance in memory scores when controlling for depression with marginal significance. When controlling for age, although less clear, these patterns remained.

**Conclusions:** Overall, these findings suggest that apathy and depression may exert unique effects on memory and executive function. Differentiation of apathy and depression has robust implications for the advancement of psychological science and patient care. A focus on apathy symptoms in patients may optimize treatment approaches, improve patients' daily functioning, increase independence, and result in an improved quality of life for both patients and their caregivers.

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#### V. DRAGO, P. FOSTER, F. SKIDMORE & K. HEILMAN. **Creativity in Parkinson disease as a function of right versus left hemibody onset.**

**Objective:** Creativity is heavily dependant on divergent thinking and divergent thinking appears to be strongly dependant on frontal lobe function. Since patients with Parkinson's disease (PD) often have evidence of frontal lobe dysfunction we wanted to learn if these patients have a reduction of creativity, as well as learning if the side of onset (right versus left) influences the type (verbal versus visuospatial) of decrement in creativity.

**Participants and Methods:** Participants of this study were patients with right (RHO) or left (LHO) onset PD as well as matched controls. All subjects were given the Abbreviated Torrance Test of Creative Thinking for Adults (ATTA), a widely used test to assess creativity that examines fluency, originality, flexibility and elaboration. Subjects were also assessed with the Controlled Word Association Test (COWAT).

**Results:** When compared to controls the patients with RHO, but not LHO had a decrease of verbal creative fluency.

**Conclusions:** Patients with PD often have a decrease on the COWAT, but the RHO versus LHO subjects' performance on the COWAT did not differ, suggesting that patients with PD who have RHO have a decrease in verbal creativity and this decrement does not appear to be related to decreased fluency.

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**V. DRAGO, P. FOSTER, M. OKUN, F. COSENTINO, R. CONIGLIARO, F. SKIDMORE & K. HEILMAN. Turning off artistic ability: The Influence of Left DBS in Art Production.**

**Objective:** The influence of Parkinson's disease (PD) as well as deep brain stimulation (DBS) on visual-artistic production of people who have been artists is unclear. We systematically assessed the artistic-creative productions of a patient with PD who was referred to us for management of a left subthalamic region (STN) DBS placed at another institution. A three dimensional reconstruction revealed the lead was deep with the 2 active DBS lead contacts were in the left ventral STN and dorsal substantia nigra (SNR) respectively. The patient was an artist before her disease started, permitting us to analyze changes in her artistic-creative production over the course of the illness and during her treatment with DBS.

**Participants and Methods:** We collected her paintings from four time periods: Time 1 (Early Pre-Presymptomatic), Time 2 (Later Presymptomatic), Time 3 (Symptomatic), and Time 4 (DBS Symptomatic). A total of 59 paintings were submitted to a panel of judges, who rated the paintings on 6 different artistic qualities including: aesthetics, closure, evocative impact, novelty, representation, technique.

**Results:** Aesthetics and evocative impact significantly declined from Time 2 to Time 4. Representation and technique indicated a curvilinear relationship, with initial improvement from Time 1 to Time 2 followed by a decline from Time 2 to Time 4.

**Conclusions:** These results suggest that left STN/SNR-DBS impacted artistic performances in our patient. The reason for these alterations is not known, but alterations of left hemisphere functions might influence the right hemisphere which is important for artistic creativity. Alterations of the mesolimbic system might also influence creativity.

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**V. DRAGO, P. FOSTER, R. FERRI & K. HEILMAN. Distractibility and Alzheimer Disease: the "neglected" phenomenon.**

**Objective:** Pathological changes in the earlier stages of Alzheimer's disease (AD) occur bilaterally in the medial temporal lobes and temporoparietal areas. Since the temporoparietal cortex is a critical region for mediating spatial attention patients with AD might have bilateral attentional disorders. Tests of spatial neglect might not detect this abnormality since these tests primarily assess attentional asymmetries. Novel or imperative stimuli presented unilaterally can activate the attentional systems in the contralateral hemisphere and patients with degeneration of the temporoparietal region, such as those with AD, might be highly distractible or impaired at disengaging from stimuli, thereby inducing abnormal attentional biases. This study sought to determine if patients with AD are distracted by unilateral novel or imperative stimuli.

**Participants and Methods:** 11 patients with AD and 10 control subjects were asked to bisect 54 horizontal lines with no lateral stimuli, novel right or left lateral stimuli ('bottom-up' condition), and imperative left or right lateral stimuli ('top-down' condition).

**Results:** An analysis revealed, for the bottom-up condition, a significant Group by Length interaction the patients with AD having a rightward bias with short lines and a leftward bias with long lines. In the top-down condition there was a Group by Dot Location interaction. Imperative stimuli on the left sided caused more deviation (leftward) than imperative stimuli on the right.

**Conclusions:** Patients with AD have spatial attentional distractibility in the top-down, but not in the bottom-up attentional task. This attentional deficit appears to be induced by the AD subjects' reduced capacity to spatially re-allocate their attention.

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**A.J. HORNADAY, K.W. MANZEL & S.W. ANDERSON. Perseveration: Patterns of Response and Neuropsychological Context.**

**Objective:** Perseveration is the inappropriate repetition of a behavior, and has long been recognized as sign of brain dysfunction. Although common in neurologic patients, the neuropsychological context and patterns of perseverative behavior are not well understood. Here we pursued a broad-based evaluation of perseveration in a group of patients with focal brain injuries, across multiple tests, domains, and perseveration types. We hypothesized that: (1) perseveration would occur across tests, modalities, and types; and (2) perseveration would be correlated with impaired memory and executive functioning.

**Participants and Methods:** Two hundred and ninety-seven subjects with focal brain lesions participated (stroke, tumor resection, lobectomy). Perseveration was coded on two verbal and four nonverbal measures. We identified the most highly perseverative subjects on each test (typically the top quartile, depending on the distribution; total N=190).

**Results:** Of these, 38% were highly perseverative on two or more tests. Those in the most highly perseverative group on only 1 test showed more perseveration on the other tests compared to remaining subjects. When perseveration occurred on multiple tests, it tended to cross modalities (i.e., 56% had verbal and visuospatial errors). Stuck in set perseverative errors correlated with continuous ( $r=.17$ ) and recurrent ( $r=.28$ ) errors, but continuous and recurrent errors were not correlated with one another. Perseveration was correlated with age, education, IQ, memory, visuospatial abilities, and executive functioning.

**Conclusions:** The findings support the notion that perseverative tendencies cut across task demands and cognitive domains, and that perseveration occurs in the context of associated and likely contributing cognitive deficits.

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**N. JOHNSON, D. FLODEN, M. MURPHY, A.R. REZAI & C.S. KUBU. Impulse control problems in Parkinson disease do not impact performance on the Iowa gambling task.**

**Objective:** Some patients with Parkinson disease (PD) develop severe impulse control problems (ICP). There is a suspected link between ICP and abnormal ventral striatal function, a region implicated in other impulsive populations (i.e., addictions). Agonists that are intended to treat dopamine depletion in the dorsal striatum may effectively 'overdose' the intact ventral striatum due to high D3 receptor affinity, and thereby produce ICP (Evans et al., *Ann Neurol.* 2006;59:852-858). The current study was designed to evaluate ventral striatal function in patients with and without ICP. This is the first attempt, to our knowledge, to directly test this hypothesis.

**Participants and Methods:** Forty-eight patients diagnosed with PD, 24 with ICP and 24 without, were matched based on age, gender, education, and onset of PD. There were no group differences in disease severity. Patients underwent neuropsychological evaluation at The Cleveland Clinic between 2005 and 2008. Patients completed a task that requires ventral striatal input, the Iowa Gambling Task (IGT).

**Results:** Contrary to our hypothesis, patients with and without ICP were equally impaired on the IGT. Severity of ICP was also irrelevant to IGT performance. Moreover, the groups did not differ in agonist dosage.

**Conclusions:** Our findings suggest that ventral striatal function is equivalent in patients with and without ICP. This indicates that ICP in PD are unrelated to ventral striatal dysfunction, as measured by the IGT. The results also call into question the nature of the relationship between agonist use and development of ICP.

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**T. MAHANEY, K. GIFFORD & P. GORMAN. Case Analysis of Langerhans Cell Histiocytosis: 2 Differing Cases.**

**Objective:** Langerhans cell histiocytosis (LCH) is a rare disorder often diagnosed in childhood and characterized by accumulation of histiocytes resulting in tissue or organ lesions. Most affected patients develop bone lesions often occurring in the skull and impacting the CNS. Patients with CNS involved LCH (LCH-CNS) present with diverse clinical issues depending on impacted anatomical regions. Diagnostically, LCH-CNS can manifest in various ways such as clinical presentations and CNS symptoms. Thus, simple diagnosis cannot predict specific deficits, requiring the utility of neuropsychological testing for affected patients. This study highlights the distinct nature of LCH-CNS and importance of cognitive testing.

**Participants and Methods:** Case 1 is a 13 year old boy evidencing cognitive deficits beginning at age 10. After diagnosis of LCH at age 11, he received midline frontal resection of a granuloma and closure of a skull defect in the left occipital/parietal region.

Case 2 is an 8 year old girl who presented with possible pervasive developmental disorder. Following diagnosis of LCH at 2.5 years, she received right parietal-temporal lesion resection and subsequently developed a pituitary lesion and diabetes.

**Results:** Case 1 exhibited neuroanatomically consistent cognitive deficits including, VCI < PRI, reading impairments, and executive dysfunction. Case 2's pattern of performance was less consistent with her lesion distribution. As expected, she evidenced social, emotional, attention, executive functioning, and processing speed difficulties. Unexpectedly, she exhibited VCI < PRI.

**Conclusions:** The varying cognitive profiles of this analysis demonstrate the efficacy of neuropsychological testing in identifying cognitive deficits associated with LCH and allows for proper intervention in the academic arena. Correspondence: *Tanya Mahaney, Florida Institute of Technology, 298 Driskell St. NE, Palm Bay, FL 32907. E-mail: trm162@yahoo.com*

**A. MYERS. Is Sleep Important Among Caregivers??**

**Objective:** Behavioral interventions that support caregivers' restful sleep may delay the onset or decrease the severity of debilitating depressive symptoms. This, in turn, may increase caregivers' physical and psychological health and wellbeing.

**Participants and Methods:** A repeated-measures experimental design was used to test the feasibility and effectiveness of a brief behavioral sleep intervention for family caregivers of persons with advanced stage cancer. The psychotherapy includes stimulus control, relaxation, cognitive therapy, and sleep hygiene elements. It is individualized and delivered to accommodate caregiver burden. Six adult caregivers participated. The Pittsburgh Sleep Quality Index (PSQI), Center for Epidemiological Studies-Depression scale (CES-D), and Caregiver Quality of Life-Cancer scale (CQOLC) were used to measure self-reported sleep quality, depressive symptoms, and quality of life. Data were collected at baseline, 3 and 5 weeks, 2, 3, and 4 months post baseline.

**Results:** Improvement was seen across groups; however, intervention caregivers showed more improvement in PSQI and CES-D scores than control caregivers.

**Conclusions:** The CASI appears to be effective in improving sleep quality and depressive symptoms in caregivers of persons with cancer. Improvements in quality of life scores were similar across groups.

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**D.G. NEMETH, T. WIMBERLY OLIVIER & T. WHITTINGTON. Neurocognitive Sequelae of a Family Chronically Exposed to Carbon Monoxide Gas.**

**Objective:** According to Filley (2004), poisoning in the home from accidental exposure to carbon monoxide (CO) gas is common. Problems with attention, memory, and coordination are typical sequelae. The most

prominent neurocognitive sequelae, according to Hannay et al. (2004) include deficits in attention, memory, and the acquisition of new information; response slowing; and reduced ability to perform both forward and reversed digit span tasks (p. 270). Smith and Braden (1973) have found dyscalculia to be present as well.

**Participants and Methods:** Neuropsychologists are often called upon to evaluate individuals who have experienced chronic CO exposure. Seldom, however, has there been an opportunity for one neuropsychologist to evaluate an entire family of five, ages 47, 42, 24, 18, and 14, chronically exposed to CO for a period of over 14 months. These family members were referred for evaluation by their primary care physician who, being concerned about their evolving medical and neuropsychological symptoms, requested a baseline for future comparisons.

**Results:** This family's attentional, working memory, and/or mathematics difficulties were consistent with the prevailing literature. Also noteworthy was the fact that several members of the family had to have gallbladder surgery.

**Conclusions:** The primary care physician referred this family for neuropsychological evaluation due to their evolving medical and neurocognitive symptoms. It was clear from these evaluations that CO exposure symptoms are not always readily apparent, but do present gradually over time. Therefore, baseline and ongoing studies are needed. Correspondence: *Darlyne G. Nemeth, Ph.D., M.P., A.B.M.P., The Neuropsychology Center of Louisiana, LLC, 4611 Bluebonnet Blvd, Ste. B, Baton Rouge, LA 70809. E-mail: dgnemeth@gmail.com*

**L. OELKE, L. BUTTERFIELD, C. CIMINO, J. SANCHEZ-RAMOS & R. HAUSER. The Unique Effects of Anxiety and Depression on Cognitive Functioning in Parkinson's Disease.**

**Objective:** Depression and anxiety are common psychiatric disturbances in Parkinson's disease (PD). While traditional self-report measures contain overlapping symptoms, the Depression, Anxiety, and Stress Scales (DASS) is an instrument based on the tripartite model that separates the unique effects of depression and anxiety (i.e., anhedonia and hyperarousal). A distinction of the DASS is that somatic items have been removed from the depression scale. It was hypothesized that the unique influences of depressive and anxious symptoms would predict cognitive performance.

**Participants and Methods:** Sixty-eight PD patients completed the DASS and participated in neuropsychological testing. Two hierarchical regression analyses were conducted with executive functioning performance as the criterion variable, and two additional hierarchical regression analyses were conducted with memory performance as the criterion variable. Depression and anxiety, as measured by the DASS, served as predictors for all analyses.

**Results:** The DASS Depression Total Score significantly predicted delayed recall memory performance when entered as the first and second predictor. In contrast, the DASS Anxiety Total Score did not significantly predict performance on any of the neuropsychological measures. However, the DASS subscales tapping into non-somatic aspects of anxiety were significantly associated with several variables.

**Conclusions:** Specific non-somatic components of anxiety may be associated with neuropsychological functioning in PD. While certain somatic features included in traditional measures of depression are confounded with the core physical symptoms of PD, this may also be the case in the measurement of anxiety in PD. Further adaptations of the construct of anxiety may be necessary to obtain accurate measurement in PD patients.

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**A.Z. PISHORI, C.M. STANLEY, S. GLENN, J. KRAMER, B. MILLER & K.P. RANKIN. Crystallized Knowledge of Social Norms Is Negatively Impacted by Neurodegenerative Disease.**

**Objective:** Patients with orbitofrontal (OFC) damage, including those with frontotemporal dementia (FTD), sometimes develop an acquired sociopathy syndrome in which they break social norms without awareness or regret. It has been hypothesized that these patients retain crystallized knowledge of social rules, but lose the ability to adhere to these rules in daily life.

**Participants and Methods:** To investigate whether neurodegenerative disease (NDG) patients retain crystallized knowledge of social norms, 117 participants (34 Alzheimer's, 20 FTD, 16 semantic dementia (SemD), 11 corticobasal degeneration, 8 progressive supranuclear palsy (PSP), 5 progressive nonfluent aphasia, and 23 healthy older controls) completed a novel 22-item yes-no Social Norms Questionnaire. Subjects responded yes-no to whether behaviors were socially acceptable (e.g., "Is it OK to pick your nose in public?").

**Results:** Age, education, and race did not differ between groups, but all analyses controlled for sex and MMSE differences. Compared to controls (SNQ:  $20.5 \pm 1.1$ ), FTDs ( $16.1 \pm 3.2$ ,  $p < 0.0001$ ), SDs ( $15.8 \pm 2.5$ ,  $p = 0.0002$ ), and PSPs ( $17.6 \pm 1.8$ ,  $p = 0.0092$ ) scored significantly lower on the SNQ, and diagnosis accounted for 46% of the variance in SNQ score. ( $r^2 = .46$ ). This effect was not explained by participants' semantic loss, abstract reasoning ability, apathy, disinhibition, anxiety, or depression.

**Conclusions:** NDG diseases causing OFC damage or frontal-subcortical disconnection syndromes decrease individuals' ability to access crystallized knowledge of social norms, even when no behavioral response is required. This result challenges the hypothesis that patients with acquired sociopathy know the correct social response but fail to enact it, and provides some insight into the mechanisms of socially inappropriate behavior in NDG.

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#### V. STAMENOVA, E.A. ROY & S.E. BLACK. Recognition and production of gesture errors in limb apraxia after stroke.

**Objective:** Limb apraxia, a disorder of skilled movement, is characterized by an inability to perform gestures on verbal command (pantomime) or to recognize gestures. Pantomime deficits are more common after left hemisphere damage (LHD), while gesture recognition deficits could occur after LHD or right hemisphere damage (RHD). Our goal was to examine the effects of hemisphere and pantomime deficits (apraxia) on gesture error recognition (GER) and if gesture dimensions (e.g., hand posture) are affected differently in P versus GER.

**Participants and Methods:** LHD ( $n=24$ ) and RHD ( $n=27$ ) stroke patients with ( $n=17$ ) or without apraxia ( $n=34$ ) based on their pantomime of transitive gestures (apraxia defined as 2SD's below the performance of 30 controls) completed a GER test. Participants indicated whether a videotaped gesture was performed correctly or erroneously; body-part as tool (posture), location or action errors were presented. Location, action and posture dimension were also scored on pantomime and were compared to these same dimensions in GER.

**Results:** A 2(Hemisphere) x 2(Apraxia Status) x 2(Task) x 3(Dimension) MANOVA revealed an effect of apraxia status; those with apraxia performed less accurately on both pantomime and GER tasks. The analysis also showed that dimension interacted with both apraxia status and hemisphere. Patients with apraxia performed less accurately on all dimensions but particularly on posture, while the LHD patients were less accurate on action and the RHD patients were less accurate on posture.

**Conclusions:** The results suggest that apraxia and hemisphere affect GER and pantomime performance independently as there is no interaction between apraxia and hemisphere. Further, these two factors appear to affect different dimensions of performance. Apraxic patients performed worse, especially in posture, regardless of hemisphere of stroke, while regardless of apraxia status the action dimension was more affected by LHD and the posture dimension was more affected by RHD. Correspondence: *Vessela Stamenova, PhD Candidate, University of Toronto, 43 Baybrook Cres., Toronto, ON M1H2R7, Canada. E-mail: vussi@gmail.com*

### Cognitive Neuroscience

#### J.W. ALBERTS, G.P. CRUCIAN & E. NEUMANN. When Our Memories Fail Us: Exploring The Accuracy and Inaccuracy of Memory.

**Objective:** This study examined processes facilitating accurate memory and preventing intrusions into memory. Participants studied word lists

and were tested on their recognition memory. The hypotheses tested were: do individuals demonstrating less efficient inhibition produce higher rates of False Memories (FMs)? does a higher rate of FMs relate to inaccurate memory? Accurate memories were assessed on the basis of correct recognition of previously studied words. FMs were assessed on the basis of intrusion of critical lure words (CLs) into recognition memory.

**Participants and Methods:** 110 Adults, assigned to one of two Control Groups (Control); and 20+ Brain Injury Adults, (Brlnj Group). A Stroop color-naming task was used to measure inhibitory control. Participants in the Brlnj group included individuals with brain injury secondary to trauma, tumour, hypoxia, stroke, and multiple sclerosis.

On the basis of Stroop Interference, participants were assigned to either a less efficient inhibitory group or a more efficient inhibitory control group. Participants studied word lists containing semantically associated words. Rates of FMs were measured as the percentage of CLs incorrectly recognised as "OLD" words during a delayed recall task. Accurate recall was measured as the percentage of list words correctly recognised as "OLD". Inaccurate recall was measured as the percentage of distracter words incorrectly recognised as "OLD".

**Results:** Analysis of Variance (ANOVA) revealed a significant difference in the percentage of CLs intrusions. Individuals who demonstrated less efficient inhibition also exhibited significantly higher rates of CL intrusions. Those in the Brlnj Group were found to produce a significantly higher rate of CL intrusions compared to the more efficient inhibitor group, with no significant differences found in relation to accurate recall.

**Conclusions:** We found False Memories related to the inability to inhibit an automatic cognitive response, but not to inaccurate memory.

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#### D. BOWERS, U.S. SPRINGER, A.E. MIKOS, M. SYME, C. SAPIENZA, H.H. FERNANDEZ & M.S. OKUN. Dopamine and Masked Faces in Parkinson Disease: Timing is Key.

**Objective:** In previous studies we used computer digitizing methods for quantifying dynamic facial expressions and found less robust movement changes in Parkinson Disease (PD) patients compared to controls. The present study investigated what aspects of facial expressivity (i.e., temporal, overall movement) are influenced by dopaminergic deficiency in PD.

**Participants and Methods:** Thirty-nine idiopathic PD patients were videotaped while posing emotional expressions during ON and OFF dopaminergic

conditions (12 hour washout). Controls included 20 healthy age-matched individuals tested on two occasions. Expressions were digitized and analyzed for dynamic movement changes using custom software (CHEES) that provided indices of initiation time, peak rate of change, and overall facial movement. "On-Off dopa" testing order was counterbalanced across different days. Participants were neither depressed nor demented, and the Parkinson patients were in the mid-stages of their disease.

**Results:** Using repeated measures ANOVA's, we found that dopa medication significantly increased the "peak rate" of facial change ( $p < 0.001$ ) and reduced the initiation time of expressions ( $p < .001$ ). However, total movement during ON vs OFF dopa conditions failed to reach statistical significance ( $p < .09$ ).

**Conclusions:** These findings suggest that dopaminergic medications in PD have robust effects on temporal parameters of facial expressivity (initiation time, peak rate of change), but not on amount of overall facial movement. More broadly, these findings support the hypothesis of a role for the basal ganglia in modulating facial and other movements. The precise mechanism remains unclear and could involve either diminished activation of frontal cortical regions or movement-based suppression secondary to dopaminergic reduction.

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#### C.A. CLARK & L.J. WOODWARD. Verbal and Visuo-Spatial Working Memory in Children Born Very Preterm at Age 6 Years.

**Objective:** While previous studies have demonstrated impairments in working memory amongst children born very preterm, there is little consensus as to which aspects of working memory may be affected.

The aims of the study were: 1) to describe the profile of working memory impairments in a group of children born very preterm at corrected age 6 years; 2) to examine relationships between qualitative neonatal MRI measures of white and grey matter abnormality and later verbal and visuo-spatial working memory performance.

**Participants and Methods:** At term equivalent, 103 children born very preterm (<34 weeks GA, <1500g) underwent structural MRI scanning. At age 6 years (corrected for prematurity), these children and 108 children born full term were assessed on measures of verbal (Digit Span forward and backward) and visuo-spatial (Corsi Blocks forward and backward) short term/working memory.

**Results:** Children born very preterm performed similarly to their full term peers on the forwards, but less well on the backwards verbal ( $p < .05$ ) and visuo-spatial span measures ( $p < .001$ ). Children with moderate/severe cerebral white and grey matter abnormalities showed lower levels of performance across both verbal and spatial domains relative to the full term group ( $p < .05$ ); those with mild white and grey matter abnormalities showed difficulties specific to the more complex, backward visuo-spatial span task ( $p < .05$ ) and those with no cerebral abnormalities showed performance levels similar to full term children.

**Conclusions:** Findings suggest a profile of working impairment characterized by relatively greater difficulties in visuo-spatial working memory in school-aged children born very preterm. However, difficulties are clearly mediated by the extent of early cerebral abnormality associated with very preterm birth.

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#### M.A. COATES. Event Related Potential Evidence for Task-Set Switching in the Implicit Association Test.

**Objective:** The Implicit Association Test (IAT; Greenwald et al., 1998) appears to be a reliable measure of implicit attitudes. Although a number of cognitive operations have been proposed to account for the IAT effect, little research on the neurological processes involved during the IAT has been conducted. Mierke and Klauer (2001, 2005) have suggested that task-set switching demands differ between the congruent and incongruent conditions and result in longer reaction time in the incongruent condition. The current study is the first to test this account using Event Related Potentials (ERP). The task-set switching account predicts that all trials of the congruent condition will elicit similar electrical activity, while trials in the incongruent condition requiring a task-set switch will differ from all other trials.

**Participants and Methods:** Participants were fifteen healthy young adults recruited through word of mouth. Electrical data was collected from twelve scalp sites while participants completed a modified IAT paradigm. Each individual trial was coded based on its relationship with the preceding trial. Trials could contain a task-set switch, a response switch, both a task-set and a response switch, or no switch.

**Results:** Consistent with previous research, a significant IAT effect was observed. ERP results showed differences in the P300 waveform between congruent and incongruent conditions. Specifically, in the congruent condition there was no difference between trial types, whereas in the incongruent condition the no-switch trials elicited a lower amplitude P300 than switch trials.

**Conclusions:** Implications for the task-set switching account are discussed. Correspondence: Mark A. Coates, BSc, Psychology, University of Ottawa, 729B Waterloo St, London, ON N6A 3W2, Canada. E-mail: markc7@gmail.com

#### J.S. FEINSTEIN & D. TRANEL. Bilateral Limbic System Destruction In Man.

**Objective:** We report here a case study of a rare neurological patient with bilateral brain damage encompassing a substantial portion of his limbic system, caused by herpes simplex encephalitis (HSE). The patient has been extensively investigated with all manner of neuropsychological procedures, affording an unprecedented elaboration of the types of cognitive and behavioral deficits — or lack thereof — that can occur with bilateral limbic lobe destruction.

**Participants and Methods:** The patient, Roger, has been studied in our laboratory for over 14 years and here we present his complete neuroanatomical and neuropsychological profiles.

**Results:** The amount of destroyed neural tissue is extensive and includes bilateral damage to core limbic and paralimbic regions, including the hippocampus, amygdala, temporal poles, insular cortex, orbitofrontal cortex, basal forebrain, and anterior cingulate. The right hemisphere is more severely affected than the left, although the lesions are largely bilateral. Despite the magnitude of his brain damage, Roger has a normal IQ, average to above average attention, working memory, and executive functioning skills, and very good speech and language abilities. In fact, his only obvious presenting deficits are a dense global amnesia and severe anosmia and ageusia.

**Conclusions:** Due to significant advances in the detection and treatment of HSE, cases of bilateral limbic lobe destruction have become vanishingly rare. Roger's case presents an excellent opportunity to investigate the elements of human life which are critically dependent on the intact functioning of the limbic system.

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#### H.L. FERRETT, K. THOMAS, P. CAREY, S. CONRADIE, M. KIDD, G. FEIN & S. TAPERT. Neuropsychological Performance of South African Adolescent Treatment-naïve Alcohol Users.

**Objective:** Alcohol use disorders (AUDs) in developmentally vulnerable adolescents are ubiquitous and confer a risk for long-term neurocognitive sequelae, yet comorbid substance use disorders and psychopathology can complicate interpretation. Here, we compare cognitive functioning in adolescents with and without AUD, who are free from comorbid disorders.

**Participants and Methods:** Afrikaans-speaking adolescents (13-15yrs) of mixed ancestry and low SES were recruited from local schools in the Western cape region of South Africa. Adolescents with psychiatric, developmental or other SUDs were excluded. AUD ( $n=15$ ) and control ( $n=15$ ) groups were matched on age, gender, smoking status, and level of education. Neuropsychological testing in Afrikaans followed IRB approval, parent/participant consent/assent and medical/psychiatric evaluation. The neuropsychological battery was selected with consideration of previous findings, psychometric soundness, age-appropriateness and cultural fairness. Linguistic and cultural adaptations preceded Afrikaans translations and back-translations of all tests.

**Results:** The AUD cohort had been drinking 14 units (+/-24) of alcohol per week for 1 year, 2 days per week, on average. Our sample had a mean age of 14.4 years (+/-0.7), and 8.0 years (+/-0.9) of education with no group differences. Of 14 measures examined, AUD performed more poorly than controls on Clox 1 ( $p=.03$ ) and Clox 2-1 difference ( $p=.01$ ), and showed a trend for poorer performance on Block Design ( $p=.08$ ).

**Conclusions:** While we caution against over interpreting these preliminary data, they do suggest that executive functioning and spatial functioning may be impaired by high dose drinking in Afrikaans-speaking South African adolescents.

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#### N. GOODRICH-HUNSAKER & R.O. HOPKINS. Symptom Validity Testing, Word Memory Test Performance, Hippocampal Damage and Declarative Memory Impairments.

**Objective:** Many symptom validity tests (SVTs) assess cognitive effort and performance validity via declarative memory paradigms.

One SVT, the Word Memory Test (WMT), reports to be very sensitive in detecting poor effort or exaggeration of cognitive difficulties, yet insensitive to all but the “most extreme forms of cognitive impairment”. It is known that declarative memory requires the hippocampus and related medial temporal lobe structures. Therefore, we predicted that amnesic subjects with hippocampal damage would be impaired on the WMT.

**Participants and Methods:** We examined WMT performance in three amnesic subjects with well-documented focal bilateral hippocampal atrophy. The subjects were non-demented and cognitively intact with normal intelligence. Amnesic subjects were compared with matched control subjects.

**Results:** Amnesic subjects’ WMT scores were significantly lower than control subjects’ on all WMT conditions. Despite the lower scores than controls, the amnesic subjects’ WMT scores were above established cut-off scores on the immediate recognition, delay recognition and consistency WMT components (i.e. “passing” the WMT). In contrast, the amnesic subjects scored significantly lower than control subjects and uniformly performed below established cut-off scores on the multiple choice, paired associate, free recall and long delay free recall WMT components (i.e. “poor effort” or “disingenuous performance”).

**Conclusions:** These results demonstrate how amnesic subjects with bilateral hippocampal damage inform us about the role of the hippocampus in WMT performance. Performance of the WMT is disrupted in amnesic patients with hippocampus damage. When genuine neural impairments disrupt the neural circuitry that subserves declarative memory, this may result in impaired performance on the WMT tests, which in no way reflect disingenuous performance or poor effort. This study underscores the need for understanding the cognitive functions and neural systems that underlie SVT performance, like the WMT.

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**A. JEGEDE, D. ROSADO-RIVERA, EDD, A.M. SPUNGEN, EDD, C.P. CARDOZO, MD, W.A. BAUMAN, MD & J.M. WECHT, EDD. Blood Pressure and Cerebral Blood Flow Response to the Stroop Color-Word Task in Persons with Spinal Cord Injury.**

**Objective:** Background: Reduced cognitive function may be related to cerebral hypoperfusion and hypotension. Despite the cognitive difficulties noted in approximately 41% of the spinal cord injured (SCI) population, little is known regarding cerebral blood flow (CBF) responses during cognitive tasks.

**Purpose:** To assess blood pressure (BP) and changes in CBF during the Stroop Color-Word Test in individuals with SCI and controls.

**Participants and Methods:** Research Design: Cross-sectional pilot study using Transcranial Doppler ultrasound to assess CBF in the left middle cerebral artery (MCA). Data, reported as raw score (mean±SD), were collected seated at rest and then again while completing the Stroop task. Method: Six individuals with SCI (>6 months of injury) and six controls (42±12 vs. 39±10y, ns) were studied. T-tests were used to determine group differences for BP, CBF, and Stroop performance.

**Results:** Results: The control group had a higher level of education than the SCI group (18.8±2.7 vs. 14.2.8±3.3y, p=0.02) and performed better on Stroop color (76.8±7.5 vs. 62.8±8.4, p=0.01) and color-word (44.7±6.8 vs. 33.5±5.9, p=0.01). The SCI group had lower BP both resting (78.1±5.7 vs. 88.8±9.0, p=0.04) and during the Stroop task (72.2±8.4 vs. 85.4±5.5, p=0.01). The groups did not differ for CBF at rest or during the Stroop tasks however, a trend was noted of increased CBF in the controls but decreased CBF in the SCI group during the cognitive task.

**Conclusions:** Conclusion: Low BP associated with reduced CBF during cognitive tasks, albeit not significant, may provide insight regarding the etiology of impaired seated cognitive function in persons with SCI.

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**D.A. KAUFMAN, O. BOXER, G. STAVRO, X. CAGIGAS, P. DINA, J. CAITLIN, D. STROUP, E. WU, I. MOLNAR-SZAKACS & R.M. BILDER. Verbal Working Memory Contributions to Creativity.**

**Objective:** The abilities to maintain and manipulate information in working memory (WM) are both critical components of cognitive flexibility. While cognitive flexibility is a key element of creative thinking, little is known about the relationship between WM and creativity. The current study explores this relationship, using measures of cognitive flexibility, creative thinking, and lifetime creative achievement.

**Participants and Methods:** One hundred and twenty healthy adult participants completed the Unusual Uses subtest of the Torrance Test of Creative Thinking (TTCT), Remote Associates Test (RAT), Creative Achievement Questionnaire (CAQ), along with experimental tasks assessing verbal WM capacity and manipulation abilities. Hierarchical regression was used to examine the relationships between creativity variables and WM performance.

**Results:** Verbal WM capacity served as a significant predictor for both flexibility of responses on the TTCT and total score on the RAT. However, WM manipulation performance accounted for significantly more variance in these measures than WM capacity alone. Furthermore, creative achievement measured by the CAQ was predicted only by WM manipulation abilities.

**Conclusions:** Performance on measures of cognitive flexibility (TTCT, RAT) was significantly predicted by verbal WM performance. Interestingly, the ability to manipulate information in WM was more strongly associated with creative thinking than WM capacity alone. In fact, creative achievement as measured by the CAQ was only predicted by WM manipulation performance. These results indicate that the ability to maintain and manipulate verbal information in WM is critically important for both creative thinking and creative achievement.

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**S. KAZANDJIAN, A. ZIVOTOFKY & S. CHOKRON. Bidirectional Reading on Cancellation Task Performance.**

**Objective:** Past studies on cancellation task performance have found a left-to-right (LR)/top-to-bottom (TB) pattern among Indo-European readers and a right-to-left (RL)/TB pattern among Semitic readers. These patterns have been associated with both brain-mediated directional and reading direction biases. Among bidirectional readers, reading direction bias is not straight-forward. This study examined the role of reading proficiency and language environment on cancellation tasks of bidirectional readers.

**Participants and Methods:** Sixteen low-English, native Hebrew (L-HEB), 13 high-English, native Hebrew (H-HEB), and 14 high Hebrew, native English (EHB) bidirectional readers performed random-array (Mesulum & Weintraub, 1985) and ordered-array (Diller et al., 1974) letter and shape cancellation tasks presented in English and in Hebrew. Reading group and language environment were compared for Start location and Strategy using chi square tests, and Error rates within quadrants were analyzed with a repeated-measures ANOVA.

**Results:** For Start Location and Strategy, differences were seen for the ordered-array tasks (letter and shape). L-HEBs preferred to start at the left hemispace and use a LR/TB strategy during the English environment, but started at the right and used a RL/TB strategy during the Hebrew environment. For error rate by quadrant, there were no differences in terms of reading group or language environment.

**Conclusions:** In contrast to previous studies with monolinguals, bidirectional readers do not exhibit a directional bias in completing random-array cancellation tasks. However, on ordered-array tasks that resemble text, a language-dependent bias was seen for the low-proficient bidirectional readers only. We discuss the possible interaction between visual material, orientation of attention, reading direction and bidirectional proficiency, and brain organization.



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**W.D. KILLGORE, D.B. KILLGORE, G.H. KAMIMORI & T.J. BALKIN. When Being Smart is a Liability: More Intelligent Individuals May Be Less Resistant to Sleep Deprivation.**

**Objective:** Individuals show trait-like differences in their ability to sustain alertness and vigilance in the face of prolonged wakefulness. Several factors appear to contribute to this ability, including age, personality, genetics, and regional brain activity. The Cognitive Reserve Hypothesis (CRH) posits that individuals with greater cognitive capacity should have more reserve function to draw from to compensate for sleep loss-induced decrements in cognitive functioning.

**Participants and Methods:** We evaluated the relationship between nonverbal intelligence as assessed by the Computerized Test of Nonverbal Intelligence (C-TONI), and psychomotor vigilance speed over three nights of continuous sleep deprivation. After completing the C-TONI, twenty-three healthy volunteers were deprived of sleep for 77 hours. Participants completed psychomotor vigilance testing (PVT) at regular intervals throughout each overnight period. Half of the sample also received caffeinated gum (200mg) every two hours. PVT speed was converted to percent of baseline (PVT%) for each subject for each night.

**Results:** Partial correlations, controlling for drug group and age, showed an inverse relationship between Geometric Nonverbal IQ (a measure of fluid intelligence) and average PVT performance by the third night without sleep ( $p < .05$ ), but not for the previous two nights. This was most significant during the middle and last thirds of the third night (all  $p$ -values  $< .05$ ). In contrast, Pictorial Nonverbal IQ and Total Nonverbal Intelligence were not significantly correlated with PVT.

**Conclusions:** Contrary to the CRH, higher nonverbal intelligence was associated with greater vigilance impairment. Individuals with greater intelligence may exhaust glycogen stores more readily during prolonged wakefulness, thus increasing need for restoration through sleep.

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**N.I. LANDRØ, R. JONASSEN, P. LYCHE, T. ENDESTAD, A. NEUMEISTER & T. STILES. The Effects of 5-HTTLPR Polymorphisms and Gender on Cognitive Control and on Processing of Emotional Facial Expressions.**

**Objective:** Serotonin is central in emotion regulation and the short (s) allele of the serotonin transporter gene (5-HTTLPR) has been linked to negative emotionality and to vulnerability to the development of depressive symptoms. Serotonergic modulation of prefrontal brain areas implicate an association with higher cognitive control functions. However, studies examining the role of 5-HTTLPR in cognition are very few. In this study we investigated whether 5-HTTLPR polymorphisms influence basic cognitive control and processing of emotional facial expressions. We also intended to investigate possible interactions of this genotype with gender.

**Participants and Methods:** Sixty healthy individuals, 34 females and 26 males (mean age 30.8 years), were included. They were screened for psychopathology applying SCID I and SCID II. Basic cognitive control was measured with the Stroop Color Naming Test, whereas processing of emotionally salient information was based on a new paradigm, The Emo n-back Task. Sequential pictures of sad, happy, fearful and neutral faces were presented within a working memory context. The subjects were asked to respond each time the same facial expression was presented in succession.

**Results:** In the Stroop Test there was an effect of gender, but no main effect of 5-HTTLPR variants or genotype by gender interaction. In The Emo n-back Task there was a statistically significant three-way interaction between emotional category, sex and genotype on accuracy. Female short 5-HTTLPR carriers demonstrate a specific increased sensitivity to the sad category.

**Conclusions:** Such a specific bias towards sad facial expressions in healthy female short allele 5-HTTLPR carriers might indicate a cognitive pathway linking underlying biology and vulnerability for the development of depression.

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**S.L. LEININGER, J. WIEGAND, N. TLOCZYNSKI & R.L. SKEEL. The Effects of Reward Magnitude Discrepancies and Uncertainty Periods on Michigan Gambling Task (MGT) Performance.**

**Objective:** The Iowa Gambling Task (IGT) (Bechara, Damasio, Damasio, & Anderson, 1994) has been commonly used to investigate variables involved in decision-making under uncertainty. Specifically, research has demonstrated that increased reward magnitude discrepancies between advantageous and disadvantageous decks can lead to suboptimal IGT performance (van den Bos, Houx, and Spruijt, 2006). In addition, animal research has shown that increased dopaminergic activation occurs during anticipatory periods before potential delivery of rewards, which may be reinforcing in and of itself (Adinoff, 2004; Fiorillo, 2004). Thus, the current study used the Michigan Gambling Task (MGT), a modified IGT, to investigate the impact of reward magnitude discrepancies and delay periods between choice selection and outcome.

**Participants and Methods:** One hundred and five participants were randomly assigned in a 2 [reward magnitude: \$100:\$50 (2:1) vs. \$300:\$50 (6:1)] by 2 [delay decks: disadvantageous decks A/B vs. advantageous decks C/D] by 5 [5 repeated measure blocks consisting of 20 card selections per block] design. It was hypothesized that disadvantageous decks would be preferred with increased magnitude discrepancies and time delay periods.

**Results:** Contrary to prediction, there were no main effects of magnitude or uncertainty periods;  $F(3,101) = .577, p = .631, \eta^2 = .017$ .

**Conclusions:** The current study did not contain traditional instructions stating that "some decks are better than others," as research indicates this increases the rate of task learning (Fernie & Tunney, 2006). This instructional modification could have influenced current study results; thus, researchers should be aware of methodological variations when reviewing literature and considering study designs.

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**P.D. LEO & A.J. GREENE. The hippocampus and inference: an fMRI analysis.**

**Objective:** To examine hippocampal activation during an inference task above and beyond simple context dependent decisions.

**Participants and Methods:** Participants were healthy college age students trained on two different visual relational learning tasks. Participants were randomly assigned to either an inference group where a relationship between stimulus items could be inferred (Inference,  $n=15$ ) or a context only group where participants were simply asked to make context dependent decisions (Context,  $n=10$ ). During the task event related whole brain imaging was performed using a GE 3T scanner. After image acquisition a hippocampal region of interest analysis was performed with AFNI to contrast activation in the inference condition compared to the context only condition.

**Results:** The inference group showed significantly greater bilateral hippocampal activation than the context only group.

**Conclusions:** The human hippocampus supports inferential decisions beyond basic context dependent decisions and the right hippocampus may play an important role in the inference task. This relational learning task may be sensitive to clinical populations with compromised right hippocampal functioning.

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**L.D. COSAND, K. OIE, C.G. COURTNEY, A.V. IYER, A.A. RIZZO & T.D. PARSONS. High and Low Immersion in Virtual Reality: A Psychophysiological Assessment.**

**Objective:** As technology develops, virtual reality is becoming increasingly common in the assessment and treatment of neuropsychological deficits. While intuition suggests that virtual reality is more engaging than a standard computerized task, empirical evidence is needed to justify its monetary and resource requirements in a clinical setting.

**Participants and Methods:** In the present study, the impact of highly immersive virtual reality on participants' psychophysiological responses was compared with responses to a less immersive experience of watching the scenario on a laptop screen. The High Immersion condition (HI) utilized a head-mounted display, headphones, and a tactile transducer. In the Low Immersion (LI) condition, participants wore headphones and watched the scene on a laptop computer screen. The stimuli were a series of military scenes in a virtual Iraq, intermittently probed with acoustic startles. Dependent measures included two psychophysiological measures and responses on two self-report questionnaires (Tellegen Absorption Scale and Immersive Tendencies Questionnaire).

**Results:** HI participants' psychophysiological responses were higher than the responses of participants in the LI condition. Median startle eyeblink amplitudes were significantly ( $p < .001$ ) higher in the HI condition than the LI condition, as were the median interbeat intervals ( $p < .02$ ), when accounting for individual differences in absorptive and immersive tendencies.

**Conclusions:** Highly immersive virtual reality experiences evoke greater psychophysiological responses than lower immersion experiences, suggesting a stronger impact on the participant.

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**C.G. COURTNEY, A.V. IYER, L.C. COSAND, K. OIE, A.A. RIZZO & T.D. PARSONS. Psychophysiological Affects of High and Low Levels of Immersion in an Iraqi Virtual Environment on West Point Cadets and Civilian Controls.**

**Objective:** Although virtual environments (VE) have been utilized to train future military leaders (e.g. West Point cadets) to handle complex combat relevant scenarios, specialized cadet training may decrease the arousing effect of VEs on cadets.

**Participants and Methods:** Six cadets and 8 civilians were placed in a highly immersive condition (HIC) consisting of a head mounted display, headphones, and a tactile transducer floor to simulate riding in a large vehicle; and a less immersive condition (LIC) consisting of watching the scenario on a 17 inch laptop screen while wearing headphones. The VE included a series of safe and combat zones with intermittently placed 110 dB acoustic startle probes which Ss experienced while driving a Humvee. Psychophysiological measures of startle eyeblink amplitude and heart rate were recorded.

**Results:** Cadets responded with significantly lower eyeblink amplitudes ( $F=7.249, p<0.05$ ) overall. Ss in the HIC, cadet or civilian, had higher eyeblink amplitudes than did the Ss in the LIC. A significant interaction between condition (HIC or LIC) and subject group (cadet or civilian) was also found in relation to heart rate. Cadets had significantly slower heart rates during the LIC compared to civilians ( $F=17.662, p<0.001$ ), while their average median heart rates in the HIC were nearly identical (cadet mean = 0.802, civilian mean = 0.799,  $F=0.001, p=0.997$ ).

**Conclusions:** Results suggest that although cadets found the VE to be a less negative experience than did the civilian controls, the HIC was a more emotionally salient condition. Hence, highly immersive VEs can be effective training tools in simulating military scenarios.

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**A.V. IYER, L.C. COSAND, C.G. COURTNEY, A.A. RIZZO & T.D. PARSONS. Psychophysiological Correlates of Immersive Tendencies in Virtual Environments.**

**Objective:** 'Immersive tendency' of a subject is the degree to which the subject is predisposed towards behaving in a Virtual Environment (VE) as if it were a real one. Knowing the expected immersive tendency of potential users of a (Virtual Reality)VR system, will help decide the value of useful investment in immersion-producing technology. Studies so far have been relying upon subject-reported immersive tendency assessments, most notably the Immersive Tendencies Questionnaire (ITQ). (Witmer and Singer, 1974). Heart rate is an index of autonomic nervous system response which shows significant differences for subjects with high and low immersive tendency as obtained from the ITQ, and can usefully complement questionnaire-based measures of immersive tendency with an objective psychophysiological metric.

**Participants and Methods:** In the present study, ECG recordings were obtained from subjects exposed to a VE, after they were administered an ITQ questionnaire. The stimuli were a series of safe and combat zone scenes experienced by a rider in a Humvee patrolling a virtual Iraqi city. The ECG recordings were obtained unobtrusively using a three-lead montage and analyzed to obtain median RR interval (inter-beat interval) in each zone, which would function as an indirect measure of heart-rate. The correlation of the total score of the ITQ and the median RR interval was examined.

**Results:** The total ITQ showed a significant negative correlation with the median inter-beat interval ( $r = -0.158, p < 0.05$ ).

**Conclusions:** Results suggest that subjects with higher immersive tendencies according to total ITQ score, have higher heart rates when subjected to VEs.

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**M.F. SCHWARTZ, D.Y. KIMBERG, B. COSLETT, A.R. BRECHER, L.H. BARDE, G.M. WALKER & G.S. DELL. Factor Analysis of Aphasia Battery Validates the Semantic-Phonological Distinction in Input and Output Word Processing.**

**Objective:** Many language theories identify semantic and phonological subsystems as primary and distinct. We factor analyzed scores on a language battery for aphasia to confirm the distinction in input and output processing and identify highest-loading measures.

**Participants and Methods:** Fifty-seven individuals with post-stroke, chronic aphasia completed a battery of tests chosen to tap semantic and phonological processes in comprehension, production, and short-term memory. Factor analysis was carried out with the factanal() routine in R version 2.7.1, using 19 measures, with the varimax (default) rotation applied to the factor loadings. Beginning with 2, solutions with increasing numbers of factors were calculated until additional factors proved uninterpretable to an experienced aphasia researcher by inspection of the factor loadings.

**Results:** Models with 2, 3, or 4 factors were all naturally interpretable within the semantic-phonological framework. In the 2-factor model, factor 1 (.272 variance explained) loaded highly on phonological measures (highest loader = nonword repetition), and factor 2 (.264 variance explained) loaded highly on semantic measures (highest loader = related-picture matching). The 4-factor model split each of these into input and

output: factor 1: phonological input processing (e.g. auditory discrimination of minimal pairs); factor 2: phonological output (e.g. proportion of nonword naming errors); factor 3: semantic comprehension (e.g. related-picture matching); factor 4: lexical-semantic output (e.g., proportion of semantic naming errors).

**Conclusions:** Factor analysis of a test battery for aphasia confirmed the semantic-phonologic distinction for input and output processing. Results are useful for mapping language networks with deficit- and activation-based paradigms.

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**R.J. THOMA, D. RUHL, M. MONNIG, P. LYSNE, M. EULER, D. HAMPTON, J. POMMY, S. MURIADA, L. LUNDY & F. HANLON. Impaired Ipsilateral Sensory Gating and Memory Performance in Unilateral Temporal Lobe Resection.**

**Objective:** 50 ms sensory gating refers to the reduction in amplitude in the ERP associated with the response to similar stimuli. It is also thought to refer to a process by which the response to redundant or irrelevant stimuli is suppressed so as not to overwhelm an organism's finite cognitive resources. Auditory cortex on the superior temporal gyrus is considered the principal site of that activity in humans, but evidence from animal studies and depth-recording electrodes in epilepsy have suggested a role for the hippocampus in sensory gating.

**Participants and Methods:** Sensory gating and neuropsychological functioning were assessed in groups of seizure-free, post-surgical patients with temporal lobe epilepsy who underwent medial temporal lobe resection (TLR) and healthy control subjects. Four right temporal lobe resection patients, four left TLR patients, and seven non-clinical healthy control subjects were evaluated in a 50 ms paired-click paradigm with EEG and 275-channel MEG. Gating was operationalized as the ratio between the evoked response to the first click and the response to the second.

**Results:** The TLR groups exhibited significantly decreased ERP P50 gating (i.e., higher gating ratios) relative to controls. They also showed impaired ERF P50m gating in the auditory cortex ipsilateral to the resection but showed no such contralateral deficiency. Resection patients were impaired relative to controls on memory tests, and there was a significant interaction in which left TLR patients performed more poorly on verbal memory tests and right TLR patients performed more poorly on visual memory tests.

**Conclusions:** These results are consistent with the hypothesis that the hippocampus plays a critical role, not just for memory, but also for control of auditory sensation.

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**E. WALDRON & A.E. HERNANDEZ. Past Tense Verb Generation Depends Upon Word Age of Acquisition: Evidence from fMRI.**

**Objective:** The declarative / procedural model has been applied to many cognitive functions, one of which is syntactic processing. This model, however, has not been met with unquestioned acceptance for this task. Additionally, some have discussed the impact of word age of acquisition (Ullman, 2004) as it relates to the declarative / procedural hypothesis, but this factor has not yet been examined within the context of a functional imaging study of syntactic processing.

**Participants and Methods:** To test this idea, 14 English-speaking monolinguals covertly generated the past tense form of regular and irregular verbs while being scanned by fMRI.

**Results:** Analyses revealed activation in the left Rolandic operculum that extended posteriorly to the supramarginal gyrus, right BA 4, and cuneus for past-tense generation of regular > irregular verbs. When stimuli were controlled for phonological complexity, similar patterns emerged.

The irregular > regular verb contrast revealed no significant activations at  $p < .001$ , though ROI analyses replicated extant findings from the literature. Irregular verb stimuli sorted by age of acquisition, which revealed activations in the right hemisphere angular gyrus, precuneus, and left hemisphere caudate for early learned words.

**Conclusions:** Critically, it appears that our results do not support the declarative / procedural hypothesis and only lend partial support to the single route model of past tense generation. Rather, our data implicate the importance for the age at which mastery of past tense generation for each verb is achieved, with greater reliance on phonological and auditory analysis processes for regular verbs and early-learned irregular verbs. Correspondence: *Eric Waldron, M.A., Psychology, University of Houston, 7490 Brompton St., Apt. 180, Houston, TX 77025. E-mail: ejwaldron@uh.edu*

**Electrophysiology/EEG/ERP**

**D. CANTOR & R. CHABOT. QEEG and VARETA/LORETA Correlates to Neuropsychological Performance.**

**Objective:** The derivation of QEEG predictive functions may play a critical role in using QEEG measures that predict potential functional impairment in populations such as "children at risk", or following acute mild head trauma in sports injuries and for soldiers on the battlefield theatres.

**Participants and Methods:** EEG was obtained from over 200 individuals ranging in age from 4 to 75 years diagnosed with a variety of disorders. All EEG data used a 19 site monopolar montage. Delta, theta, alpha, and beta frequency bands with derived absolute power, relative power, power asymmetry (inter and intrahemispheric), coherence, and mean frequency was attained and then converted to z-scores relative to a database of age-matched normal children. Correlation analyses were used to define specific univariate and multivariate QEEG measures that correlate with various neuropsychological tests and their subtests for many cognitive and motor functions. Step-wise regression equations were derived in order that predictive estimates for neuropsychological test performance could be extrapolated from brain functional measures.

**Results:** Analyses revealed distinctive predictive equations for human performance spanning a wide range of human performance. VARETA and LORETA source location analyses were used to derive the "resting state" cortical and subcortical structures involved that correspond to gradients of neuropsychological performance. Pilot data from equations demonstrated predictive validity to test neuropsychological performance prior to testing with over 90% of the variances accounted using selected QEEG measures.

**Conclusions:** This study demonstrates that QEEG can be used to screen for brain functional impairment with prediction of specific neuropsychological deficits that may require further assessment and intervention.

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**M. CHEUNG & A.S. CHAN. A Quantitative Electroencephalography Study of Reading English Words and Chinese Characters.**

**Objective:** To study the electrophysiological correlates of reading English words and Chinese characters

**Participants and Methods:** We recorded quantitative EEG (qEEG) in 16 normal subjects with Ag/AgCl electrodes from 64 electrodes sites placed according to the extended international 10-20 system. EEG was digitized at a sampling rate of 1000Hz with filter settings of 0.05Hz (high pass) and 200Hz (low pass). Impedance did not exceed 10 kohms across all sites. During recording, subjects were invited to read overtly 24 English words or 24 Chinese characters presented for 5 seconds in four conditions: neutral English words, neutral Chinese two-character words, English words associated with brand names and their corresponding Chinese words. The EEG was off-lined filtered with band pass

0.5–30 Hz at 48db/octave. Epochs of 1024ms duration were extracted from the continuous EEG and separately averaged. Average power spectra for eight frequency bands: delta (1–4Hz), theta (4–8Hz), low alpha (8–10 Hz), high alpha (10–12Hz), low beta (12–18Hz) and high beta (18–30Hz) were finally computed for four conditions.

**Results:** Compared with reading English words, reading Chinese characters demonstrated an increase in low beta in the right frontal regions ( $p < 0.05$ ). While comparing with neutral English words, reading words associated with brand names showed a significant increase in theta power in the lateral frontal and temporal lobe bilaterally ( $p < 0.01$ ) whereas the difference in theta power was limited to the right frontal lobe in Chinese conditions ( $p < 0.05$ ).

**Conclusions:** The present study demonstrated that right hemisphere was involved in reading Chinese and words associated with brand names had distinct electrophysiological correlates linking to the frontal lobe.

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#### N.R. CLANTON & J.E. LOCHMAN. Psychophysiological Correlates of Aggressive Behavior in Children: An Examination of Differences Between Recovery Responses.

**Objective:** Understanding aggressive children's physiological responses can provide additional clues regarding the way the brain emotionally processes information. The current study extends this notion to also evaluate how aggressive children continue to respond and recover physiologically after experiencing a provocation.

**Participants and Methods:** Eighty-one males and females between the ages of 9–11 played a computer pinball game and were provoked in competition against an unknown peer. Skin conductance (SCL) was measured continuously and cortisol was measured at baseline, immediately following the game, and 20 minutes after the game. Aggressive responses by the participant, teacher and parent ratings of aggression, and self-report of anger were collected.

**Results:** Results indicated that children with reactive aggressive behavior tended to have higher SCL and cortisol levels following provocation. Males who were rated as aggressive by teachers, parents, self, and observation displayed higher physiological responses during the recovery period. Caucasians who were rated as aggressive across these measures tended to display lower arousal during the recovery period. In contrast, African Americans who were rated as aggressive displayed higher arousal during the recovery period.

**Conclusions:** In general, males had greater difficulty recovering from a period of reactivity. If physiological responses reflect an emotional state, it appears that children with high levels of reactive aggressive behavior in particular demonstrate difficulty in recovering from emotional arousal, as expressed by physiological responses within their sympathetic nervous system and endocrine system through the HPA axis. The implications for understanding how these processes may relate to the brain's processing of emotions are very important for intervention efforts.

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#### L.M. ERCOLI, P. SIDDARTH, J.B. DAVE, V. KEPE, K.J. MILLER, H. HUANG, H. LAVRETSKY, J.R. BARRIO & G.W. SMALL. Differential FDDNP PET Patterns in Persons with Amnesic Mild Cognitive Impairment and Normal Cognition.

**Objective:** We explored whether positron emission tomography (PET) with 2-(1-{6-[(2-[F-18]fluoroethyl)(methyl) amino]-2-naphthyl} ethylidene)malononitrile (FDDNP), a molecule that binds to plaques and tangles in vitro, might identify homogeneous subgroups of middle-aged and older persons with amnesic mild cognitive impairment (MCI) or normal cognition (NC).

**Participants and Methods:** Fifty-six subjects (MCI,  $N = 29$ ; NC,  $N = 27$ ) underwent FDDNP-PET scanning. Logan parametric images were

produced; relative distribution volumes were obtained for regions of interest (ROIs) known to accumulate plaques and tangles in Alzheimer's disease. Cluster analysis was used to identify subgroups of subjects according to FDDNP signal distribution. All subjects received neuropsychological testing at baseline; and 14 (MCI = 6; NC = 8) were followed over an average of 3.5 years.

**Results:** Three FDDNP signal clusters were identified: High signal in lateral temporal and posterior cingulate ROIs (high temporal-posterior cingulate HT/PC); low signal in all ROIs (low global cluster, LG); high frontal and parietal signal with intermediate temporal and posterior cingulate signal (HF/PA). Most MCI subjects belonged to HT/PC and HF/PA clusters; most cognitively normal subjects were in LG. The HT/PC and HF/PA clusters performed significantly worse on cognitive testing than LG. Compared to LG, HF/PA had the most extensive deficits. HT/PC and HF/PA did not significantly differ from each other. Two MCI subjects from HF/PA converted to dementia over the follow-up.

**Conclusions:** This approach may be useful in identifying potential high risk imaging cluster patterns. Longitudinal follow-up will determine the association of these subgroups with diagnostic outcome.

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#### A. HARTZELL, S. KEEDY, S. ALL, R.E. GUR & R. ERWIN. Beta and Gamma Contributions to P50 Subcomponent Abnormalities in Schizophrenia and their Relationship to Neuropsychological Indices of Attention.

**Objective:** Studies examining impaired sensory gating of the P50 component of the auditory evoked potential (AEP) in schizophrenia (SZ) typically use a bandpass of 10–100 Hz. Recent evidence suggest that this bandpass groups two distinct frequency bands beta (12–20 Hz) and gamma (30–50 Hz) together and obscures important information about their unique contributions, which are associated with separate stages of information-processing and attention. We have previously reported that P50 subcomponents (10–100 Hz) dissociated P50 abnormalities in schizophrenia with a midline component showing deficits in initial P50 amplitude and a later frontotemporal subcomponent showing deficits in suppression of P50. This study examined P50 subcomponents, using separate beta and gamma filter settings, to identify whether beta and/or gamma subcomponents were associated with distinct P50 abnormalities and whether these abnormalities were associated with deficits in attention.

**Participants and Methods:** AEP data were collected on healthy controls (HC) and SZ patients using a 32-channel recording array with a paired click protocol (0.5s ISI, 10s ITI). Subcomponents derived from both temporal and spatial PCA analysis of a HC sample were applied to a matched sample of HC ( $n=25$ ) and SZ ( $n=25$ ) patients and these data were examined for both group differences in subcomponent amplitudes as well as associations with neuropsychological indices of attention.

**Results:** Temporal and spatial PCA analyses of control data revealed a frontotemporal subcomponent in the beta analysis and both a midline and later frontotemporal subcomponent in the gamma analysis. For beta, abnormal P50 suppression was associated with worse performance on several neuropsychological measures. For gamma, lower initial P50 amplitudes were associated with deficits on only one measure of attention.

**Conclusions:** This study provides further evidence of relationships between attention and P50 suppression deficits in schizophrenia which appear to be linked primarily to beta contributions.

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#### A.K. HOLLAND, J.E. CARMONA & D.W. HARRISON. Changes in Temporal Beta Activation as a Function of Hostility and Stress.

**Objective:** The multidimensional definition of hostility, along with its strong association with cardiovascular disease and prevalence in the population (Williams & Williams, 1993) has prompted the development of

a neuropsychological model of the functional cerebral systems that involve these dimensions of hostility. Focal increases in beta magnitude have been associated with increased states of arousal (Demaree & Harrison, 1996). It was predicted that high hostile men would demonstrate heightened beta magnitude across temporal electrode sites under high arousal conditions where regulation of physiological pain concurrent with right frontal task demands was required.

**Participants and Methods:** Participants were classified as either high-hostile or low-hostile using scores obtained from the Cook-Medley Hostility Scale (Cook & Medley, 1954) and were administered the Ruff Figural Fluency Test (RFFT) twice in one session. Participants underwent left-handed cold pressor stress before the second design fluency test to increase physiological arousal. EEG data was recorded before and after each experimental manipulation.

**Results:** A Hostile x Condition interaction was found ( $F(1, 38) = 4.19$ ,  $p < .05$ ), indicating an increase in beta magnitude for high hostile men after the second administration of the RFFT. Moreover, a Hostile x Condition x Hemisphere interaction was found ( $F(1, 38) = 7.88$ ,  $p < .01$ ), indicating an increase in temporal beta magnitude at the left electrode site for high hostile men.

**Conclusions:** High hostile men demonstrated an enhanced increase in temporal activation after exposure to right-lateralized cognitive and physiological stress. Given that increases in temporal activation have been associated with increases in blood pressure and heart rate (Shenai & Harrison 2003), the results suggest an inability for high hostile men to maintain adequate levels of activation in a dual task paradigm.

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#### A.P. KEY, S.M. WILLIAMS & E. DYKENS. Affective Processing in Adults With Williams Syndrome: ERP Evidence of Social Bias.

**Objective:** Williams syndrome (WS) is a genetic disorder characterized by increased anxiety and nonsocial fears in the context of high sociability. The current study examined brain activity associated with processing of social and nonsocial affective stimuli in adults with WS.

**Participants and Methods:** Visual ERPs were recorded from 21 adults with WS (18-52 yrs) and 16 age-matched controls during an affective priming paradigm. Participants were asked to evaluate affective valence of IAPS pictures depicting social and nonsocial scenes. The pictures appeared for 2000 ms and were preceded by a 150 ms presentation of an affectively loaded social or nonsocial prime. The prime's type and affective valence matched the following picture on 50% of the trials.

**Results:** Social vs. nonsocial primes resulted in shorter RT for social targets in both groups. ERP data indicated that compared to controls, persons with WS processed social primes to a greater extent as evident in the reduced occipito-temporal EPN (150-300ms) for all targets. In both groups, social primes also led to greater affective processing of following stimuli as reflected in increased centro-parietal LPP (300-500ms) for all targets, although in WS, the increase was greater for nonsocial targets.

**Conclusions:** The results indicate that social rather than nonsocial stimuli are more likely to not only capture attention in persons with WS but also to impact affective processing of other information presented in close temporal proximity.

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#### M. KIM, B. KIM, K. JANG & S. KIM. Electrophysiological correlates of local-global processing in a sub-clinical obsessive-compulsive sample.

**Objective:** we examined local-global processing in sub-clinical obsessive-compulsives (OCs) using event-related potentials (ERPs). Particularly, we examined whether sub-clinical OCs over-focused on the local level of stimuli.

**Participants and Methods:** Psychometrical defined sub-clinical OCs ( $n=16$ ) and controls ( $n=15$ ) participated. Three configurations (congruent, incongruent, neutral) of a visual stimulus (large numbers constructed of small numbers) were used to evaluate local-global processing. A total of 240 stimuli (80 congruent, 80 incongruent, 80 neutral) were presented for global and local tasks. ERPs were measured at 64 sensor sites

**Results:** In terms of behavioral result (response times (RTs) and error rates), both sub-clinical OC and control groups showed faster RTs to the global versus local task. The control group showed significantly higher error rates when processing local versus global incongruent stimuli ( $t_{14} = -4.88$ ,  $p < 0.001$ ), whereas the sub-clinical OC group did not differ between the local and global tasks ( $t_{15} = -1.57$ , ns). In addition, sub-clinical OCs showed more errors in global, but not in local, task than the controls ( $F_{1,28} = 3.74$ ,  $p < 0.05$ ). ERP results showed that both groups had shorter N1, P2, and P3 latencies and larger P2 amplitudes during the global versus local task. Differences in local-global processing between groups were observed in terms of N2 and P3 amplitudes. The sub-clinical OCs showed larger N2 and smaller P3 amplitudes during the global versus local task, whereas the controls showed the reverse patterns. In addition, sub-clinical OCs showed longer N2 and P3 latencies in response to incongruent versus congruent or neutral stimuli, whereas the controls did not show any differences in this regard.

**Conclusions:** Behavioral and ERP results suggest that sub-clinical OCs display an attentional bias favoring the local level of stimuli, which may create difficulty in processing the global aspects of stimuli. Furthermore, these tendencies seem to precede the emergence of fully developed OC symptoms.

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#### A.M. KING, C.G. WARREN, N.E. ARMSTRONG, L. KHEIRANDISH-GOZAL, V.J. MOLFESE & D.L. MOLFESE. Event Related Potentials Express the Impact of Stress and Sleep Loss via an Auditory Attention Task.

**Objective:** Sleep restriction and stress impair cognitive processing. This study investigates the effects of stress and sleep restriction on 37 (18 female) adults between 30-45 holding advanced degrees (e.g. Ph.D.) using an oddball paradigm.

**Participants and Methods:** Participants came into the lab for testing on the seventh day of each week for two consecutive weeks. Participants responded on a 4-button response pad to 1000 and 1500 Hz tones with a 70:30 frequent to target ratio. Participants maintained normal sleep/wake cycles during week one and were then assigned to a restriction condition (0-, 1-, or 3-hour per evening loss) during the second week until follow-up testing on day 14. Sleep assignments were counterbalanced across participant and sex and were blind to researchers. Compliance was confirmed through actigraphy and self-reported sleep logs. Participants were assigned to a stress or no-stress condition that remained constant throughout test sessions. Stress was induced using an air puff device attached to the neck during both weeks. The N1 and P3 components were evaluated at centroparietal electrode sites.

**Results:** A condition by stress interaction existed for N1 latencies,  $F(1,25) = 7.893$ ,  $p = .009$ . Stress delayed N1 latencies for both frequent,  $t(25.571) = -3.310$ ,  $p = .003$ , and target,  $t(25.699) = -2.299$ ,  $p = .030$ , tones across first,  $t(27.410) = -3.107$ ,  $p = .004$ , and second,  $t(25.135) = -2.510$ ,  $p = .019$ , weeks. A week by stress interaction emerged for P3 latencies,  $F(1,25) = 6.092$ ,  $p = .021$ . The P3 was delayed during the second week only in response to the air puff,  $t(35) = 2.064$ ,  $p = .046$ .

**Conclusions:** Stress, but not minor sleep restriction, may delay attention processing in centroparietal regions.

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**P.J. MOLFESE, N.E. ARMSTRONG, V.J. MOLFESE & D.L. MOLFESE. A Longitudinal Study Of Brain Response Changes To Speech In Monozygotic And Dizygotic Twins From 6 To 18 Months Of Age.**

**Objective:** Little temporal processing information exists concerning neural responses during speech perception in monozygotic versus dizygotic twins. To address this paucity of information, the present study tracked changes in neural processing development in the same set of twins from 6 to 18 months of age.

**Participants and Methods:** A 128-channel high-density array brain recording system (EGI, Inc.) was used to record electrical brain activity (ERPs) in response to series of consonant-vowel speech syllables. Eight sets of monozygotic and 11 sets of dizygotic twins were repeatedly tested at 6, 12 and 18 months of age. Brain responses were sampled at 8 ms intervals over a 700 ms period following stimulus onset

**Results:** ERP data were analyzed using a temporal principal component analysis (PCA) that yielded a 5-factor solution accounting for 92.9% of total variance. Each factor was analyzed using repeated measures ANOVAs with Greenhouse-Geisser correction: Twin Type (2) X Age (3) X Consonant (3) X Vowel (2) X Electrode (5) X Hemisphere (2). Analyses identified a main effect for Twin Type,  $F(1,36)=4.48$ ,  $p<.04$ , as well as an interaction for Twin Type X Age X Consonant X Vowel X Electrode,  $F(6.77,243.69)=2.22$ ,  $p<.035$ , Obs. power=.81. Additional effects were noted between ages and speech discrimination.

**Conclusions:** Results indicate that ERP responses differ between monozygotic and dizygotic twins as a function of age as reflected by two temporally distinct regions of the ERP waveform.

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**K.M. O'BRIEN, E.S. BRIAN, K.N. GARROD, L. KHEIRANDISH-GOZAL, V.J. MOLFESE & D.L. MOLFESE. The Effects of Minor Sleep Restriction Elicited by an Oddball Task.**

**Objective:** ERPs elicited by an auditory oddball task examined how cognitive processes are affected by partial sleep deprivation and subsequent recovery.

**Participants and Methods:** Twenty-four participants (12 females) holding a Ph.D. or equivalent degree between the ages of 30-45 were recruited. An auditory oddball task using 1000 and 1500Hz tones with a 70:30 frequent-target ratio were played while recording participants' ERPs. Participants responded to tones on a four-button response pad. Button assignments and tones were counterbalanced across participants, sex, and testing sessions. Participants came into the lab for follow-up testing each week for three consecutive weeks. During the second week only, participants were randomly assigned to either a control or 1-hour per evening sleep loss until follow-up testing on day 14.

**Results:** A week x sleep group x hemisphere x condition interaction existed  $F(1.217,26.776)=4.732$ ,  $p=0.032$ . Group differences between the control and 1-hour sleep restricted participants existed during week 2 for frequent conditions in both hemispheres  $t_n(19.623)=3.08$ ,  $p_n=.006$  and  $t_r(18.876)=-2.489$ ,  $p_r=.022$ . The left hemisphere showed greater positivity than the right for control participants compared to sleep-restricted participants during week 2. Source localization for the 1-hour sleep restriction group illustrated maximal functioning in the temporal lobe as opposed to the amygdala activated by the control group at week 2.

**Conclusions:** Results indicate that controls exhibit memory consolidation and learning whereas those with 1-hour sleep restriction are only demonstrating simple auditory processing. Because no differences were found in response to sleep recovery, it can be argued that the effects of minor sleep loss are diminished following seven days of baseline sleep. Correspondence: *Kathleen M. O'Brien, BA of Psychology, BS of Biology, University of Louisville, 1310 Cambria Drive Apt. 6315, Schaumburg, IL 60193. E-mail: kateo2004@yahoo.com*

**G. STARKEY, D.L. MOLFESE, V.J. MOLFESE, J. BESWICK, J. JACOBI-VESSELS, P.J. MOLFESE & A. KEY. Cortical Activation During a Shape Matching Task Shows Support for Theory of Neurodevelopmental Organization.**

**Objective:** A recent theory of neural development posits that advanced cognitive functioning in children is marked by increased organization and concentrated activation of specific brain areas. It also argues that language and literacy skills impact other unrelated cognitive skills. The present study used ERP technology to examine the relationship between cortical activation in children while performing a shape matching task, and their performance on the Get Ready To Read (GRTR) literacy screening assessment.

**Participants and Methods:** Sixteen participants ranging in age from 46 to 60 months took the GRTR assessment and were divided at the median into high- and low-scoring groups. ERPs were recorded using high-density array electrode nets while these participants engaged in the shape matching task. A temporal Principal Components Analysis with Varimax rotation followed by an Analysis of Covariance identified sources of variability in ERPs.

**Results:** Results indicated that children with higher prereading scores evaluated shape congruency more quickly than children with lower scores. Furthermore, the high-scoring group showed activation in specific areas of the brain, while the low-scoring group exhibited more widely distributed activation.

**Conclusions:** These findings support theories that emphasize a high level of neural organization and specification in children with more advanced cognitive skills.

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## Imaging (Functional)

**K.J. BANGEN, K. RESTOM, T.T. LIU, C.E. WIERENGA, D.P. SALMON & M.W. BONDI. Effect of APOE Genotype on Brain Activation during Memory Encoding: An Arterial Spin Labeling Study.**

**Objective:** The apolipoprotein E (APOE)  $\epsilon 4$  allele is an important susceptibility gene for Alzheimer's disease. Arterial spin labeling (ASL) is a magnetic resonance imaging (MRI) technique that allows for simultaneous measurement of blood oxygenation level dependent (BOLD) contrast data and cerebral blood flow (CBF). Using ASL, we assessed APOE-related differences in resting state CBF as well as functional CBF and BOLD signal response to memory encoding in the medial temporal lobes (MTL).

**Participants and Methods:** T1-weighted and PICORE/QUIPSS II ASL MRI scans at rest and during picture encoding were acquired for 18 non-demented older adults including 13 non- $\epsilon 4$  carriers (mean age = 77.2 years) and 5  $\epsilon 4$  carriers (mean age = 76.6 years). Regions of interest manually outlined in native space were used in the calculation of brain volume.

**Results:** Findings showed no significant APOE group differences in MTL volume ( $p = .32$ ) or in resting state CBF ( $p = .91$ ). However,  $\epsilon 4$  carriers demonstrated a significant elevation in functional CBF ( $p = .04$ ) but not BOLD ( $p = .94$ ) response during picture encoding relative to the non- $\epsilon 4$  group.

**Conclusions:** Our findings provide evidence for APOE-related increases in MTL CBF during picture encoding, which may reflect compensatory mechanisms. The finding of between-group differences in the CBF response in the absence of BOLD differences highlights the inherent ambiguity of interpreting the BOLD data in isolation, especially in the presence of potential aging and disease factors that may involve alterations in metabolic and vascular mechanisms.

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E.M. CASTILLO, D. MEN, H. GARZA, C. BOAKE, Z. LI, M. HOSKISON & A. PAPANICOLAOU. **Changes in cortical oscillatory activity and functional recovery after stroke: a follow-up MEG study.**

**Objective:** We used magnetoencephalography (MEG) to examine how changes in the spontaneous functionality of the primary sensorimotor cortex relate to spontaneous functional changes after stroke.

**Participants and Methods:** Twenty three post-acute unilateral stroke patients suffering different degrees of motor deficit underwent evaluations at two points (1-3 months and 9-17 months after the insult). The evaluations included behavioural assessment, high resolution MRI and whole-head MEG recordings of spontaneous activity. Perirolandic delta dipole density (DDDp) in the affected and non-affected hemispheres were estimated and related to changes in behavioural measurements of motor control.

**Results:** There was a negative and significant correlation ( $r = -0.58$ ,  $p < 0.01$ ) between the degree of improvement in grip strength (kg) in the affected hand and the amount of perirolandic slow oscillatory activity (characterized as peri-Rolandic delta dipole density, DDDp) measured in the affected hemisphere.

**Conclusions:** The results suggest that spontaneous improvement in motor function after stroke is associated to changes in perirolandic oscillatory activity.

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E.M. CASTILLO, D. MEN, H. GARZA, C. BOAKE, A. PASSARO, Z. LI, M. HOSKISON & A.C. PAPANICOLAOU. **Normalization of mu Rhythms and improvement in motor function after stroke.**

**Objective:** The brain mechanisms responsible for functional recovery after stroke in patients with hemiparesis are under intense study. A better understanding of these mechanisms can help in the selection of patients that can benefit from specific therapies.

**Participants and Methods:** Using Magnetoencephalographic recordings we compared the patterns of perirolandic cortical oscillatory activity in a group of stroke patients showing significant motor improvement over time to those obtained in patients with no significant improvement. Twenty seven post-acute unilateral stroke patients presenting with different degrees of motor impairment underwent evaluations at two points (1-3 months and 9-17 months after the insult). Based on the follow-up evaluations two groups were defined: Group A, (showing significant improvement in motor control of the affected hand,  $N = 16$ ) group B (no functional improvement,  $N = 11$ ). MEG-derived spectral power was estimated for perirolandic regions on the affected and non-affected hemispheres at the moment of these two evaluations.

**Results:** Distribution of spectral power (alpha, beta, delta and theta bands) did not differ significantly in the two groups at the initial evaluation. In group A, the functional improvement in the affected hand (grip strength) was accompanied by significant increment in power (mu rhythms, 8-12 Hz) in the perirolandic regions of the affected hemisphere. No significant changes were detected in group B.

**Conclusions:** Spontaneous and partial recovery of motor functions in the affected hand after stroke is accompanied by a "normalization" of cortical oscillations. The findings suggest that increase in power (mu rhythms) can be a good indicator of local perirolandic reorganization leading to functional recovery in sensorimotor networks.

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N. DAVIS, C.J. CANNISTRACI, L.S. FUCHS, B.P. ROGERS, W. SCHRADER, A.W. ANDERSON, C. GATENBY & J.C. GORE. **An fMRI Study of Mathematical Ability in Third Grade Children.**

**Objective:** Mathematical ability varies greatly and difficulties emerging in childhood can persist through to adulthood. Very few studies have

examined the neural basis of mathematical ability in children. The objective of the current study is to quantitatively describe the patterns of brain activation associated with different levels of performance in exact calculation and estimation tasks in well defined cohorts of children with mathematical difficulty (MD) and normal controls (NC).

**Participants and Methods:** Using a Phillips 3T scanner, we obtained functional scans for eighty participants (43 NC and 37 MD) while they performed single digit exact calculation and approximate calculation tasks (within a block design). Functional data acquired during these tasks were used to create statistical activation maps for each task. Anatomical locations were determined from the local maxima of the activations. From these maps, regions of interest (ROI) were created with a minimum cluster size of  $50\text{mm}^3$ , and  $p$  value  $< .05$  (corrected) and group level comparisons of these statistical maps were performed for each math minus symbol-matching condition.

**Results:** Results from the functional imaging show robust group differences in parietal and prefrontal regions across all tasks.

**Conclusions:** Our results provide important information on the neural correlates of mathematical skill in children. In particular, it strengthens our understanding of the relationship between individual differences in children's mathematical reasoning skill and neuronal activation. Interpretation of our findings including the functional roles of the anatomical regions and their possible implications for future research will be discussed in this presentation.

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J.A. FIELDS, S.F. LONG, A.L. HESTER, M. CULLUM, L.H. LACRITZ, W.K. RINGE, P. CARMACK, H. HUANG & G. ALLEN. **Increased Posterior Cingulate Connectivity in Mild Cognitive Impairment: Evidence for a Biomarker of Alzheimer's Disease?**

**Objective:** Given evidence of early posterior cingulate cortex (PCC) involvement in Alzheimer's disease (AD) in SPECT and PET studies, we sought to determine whether reduced functional connectivity between the PCC and other brain regions characterizes mild cognitive impairment (MCI) and AD versus controls and might represent an early biomarker of dysfunction.

**Participants and Methods:** Functional connectivity magnetic resonance imaging (fcMRI) was used to examine the PCC's connectivity with brain regions in 10 AD (M age=70, M education=15), 9 MCI (M age=75, M education=12), and 10 control (NC; M age=74, M education=16) subjects. Within-group t-tests were conducted to produce group connectivity maps and analysis of variance was used to examine between-group differences in connectivity.

**Results:** Groups were similar in age and gender but the MCI group was less educated ( $p=0.005$ ). Decreased PCC connectivity in frontal lobe, temporal lobe, and cingulate gyrus regions was observed in AD compared to NC, and in frontal and temporal gyri compared to MCI. When MCI was compared to NC, decreased connectivity was observed in the cingulate gyrus and parahippocampal gyrus, while increased connectivity was found in prefrontal cortex and cerebellar regions.

**Conclusions:** PCC connectivity was generally decreased in AD compared to MCI and NC. Increased connectivity in MCI in the prefrontal cortex and cerebellum relative to NC may indicate compensatory recruitment of alternate brain regions during deficient processing in parahippocampal regions in early disease stages. fcMRI may be useful in detecting subtle brain changes in the PCC and provide evidence of a biomarker for dysfunction in MCI and AD.

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A. HALEY, F.O. BINEY & R.A. REED. **Neural Correlates of Midlife Hypertension.**

**Objective:** Midlife hypertension (HTN) is associated with significant risk for dementia. However, risk assessment is complicated by decades

of separation between onset of HTN and cognitive impairment, variable cognitive outcomes, and evidence that onset of dementia is often preceded by a decline in peripheral blood pressure. The aim of this study was to examine the relationship between blood pressure, cerebral hemodynamics, and cognition at midlife in order to aid development of early markers of dementia risk.

**Participants and Methods:** Ten adults with HTN and fourteen healthy controls (ages 40 to 60 years) completed a 2-back verbal working memory (VWM) task during fMRI. Task-related activation was averaged in empirically-defined regions of interest. Relationship between diagnosis and 2-back-related activity was examined using Student's t-tests corrected for multiple-comparisons (two-tailed  $p < .01$ ).

**Results:** Successful performance of the 2-back was associated with brain activation in expected areas. Mean 2-back accuracy was 83+11% while reaction time averaged 909+227 ms. Despite lack of performance differences among the two groups, HTN was associated with significantly greater deactivation of the posterior cingulate ( $t = 3.54$ ,  $p = .002$ ,  $df = 21$ ).

**Conclusions:** Our results indicate that mid-life HTN may be associated with sub-clinical dysfunction of VWM systems necessitating higher levels of concentration and selective withdrawal of attention from posterior cingulate-mediated, self-referential, stimulus-independent thought in order to maintain normal levels of behavioral performance. fMRI, therefore, may be a useful tool for developing new early markers of risk for vascular cognitive impairment.

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**L. JACOLA, A. BYARS, J. RASMUSSEN & S. HOLLAND. The Relationship Between Verbal IQ and Language Lateralization in Children with Epilepsy.**

**Objective:** Functional MRI is increasingly used in the evaluation of individuals with epilepsy, especially in the context of epilepsy surgery. Many studies have examined language lateralization and the concordance between fMRI and Wada test results. Although there is a wealth of clinical and research experience with Wada language scores, the same is not true of fMRI test results, particularly at the level of the individual patient. Some patient characteristics, such as age, sex, and handedness, that may relate to fMRI findings have been investigated. In this preliminary study, we investigated the relationship between Verbal IQ and language lateralization using a verb generation fMRI task in a small sample of children with epilepsy.

**Participants and Methods:** Seven children with a history of epilepsy and left-hemisphere epileptiform discharges on EEG engaged in a verb generation task during fMRI. The Wechsler Intelligence Scale, Third Edition, was also administered to each child. The fMRI task required the patient to covertly generate verbs that correspond to auditorily presented nouns. Lateralization indices (LIs) were calculated based on a compound region of interest that encompassed both anterior (left inferior frontal gyrus) and posterior (left medial temporal gyrus) language areas. We compared the correlation between LI and Verbal IQ in these children to those in a sample of 81 healthy children from a different study done in the same scanner using the same verb generation task.

**Results:** Consistent with prior research, the children with epilepsy demonstrated LIs that were significantly less left-lateralized from those of a normal comparison sample on the same task ( $LI = .16$  vs  $LI = .30$ ,  $t(5) = -2.8$ ,  $p = .04$ ). The correlation between Verbal IQ and LI was not significant for either group of children.

**Conclusions:** Although our epilepsy sample is very small, these results suggest that language lateralization based on fMRI using the verb generation task is not associated with verbal intelligence.

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**A.D. KOHL, G. WYLIE, H. GENOVA, F. HILLARY & J. DELUCA. The Neural Correlates of Mental Fatigue: A Comparative Study between Multiple Sclerosis and Traumatic Brain Injury.**

**Objective:** The present report compares two fMRI studies, DeLuca et al. (2008) using MS subjects and Kohl et al. (submitted) using TBI subjects, who take an innovative approach to objectively study mental fatigue. We hypothesize that MS/TBI subjects require greater cerebral effort to perform mental tasks, represented as an increase in brain activity, which manifests as the subjective feeling of mental fatigue.

**Participants and Methods:** DeLuca et al. (2008) - 15 healthy controls (HCs) and 15 individuals with clinically definite MS. Kohl et al. (submitted) - 11 HCs and 11 individuals with moderate-severe TBI. All subjects performed three/four blocks of a modified version of the Symbol Digit Modalities Task in an MRI scanner, requiring continuous sustained attention for 7 minutes. This enabled us to investigate cognitive fatigue both across-run (monitoring the BOLD response across three/four runs) and within-run (monitoring the BOLD response from the first half to the second half of each run).

**Results:** Similar patterns of activation were observed: frontal regions - MS: orbital gyrus (within-run); TBI: middle frontal gyrus (within-run), superior parietal cortex - MS: across-run; TBI: within-run, and basal ganglia - MS: caudate/caudate body (across-run); TBI: caudate/putamen (within-run). As expected, HCs showed decreases in activity.

**Conclusions:** Although both studies showed increased activation across time in similar areas, temporal differences were observed. The TBI group showed increased activity for the within-run analysis (indicative of fatigue over a shorter time period), while MS subjects showed evidence of fatigue over a longer time period (across-run). These similar patterns of activation might be indicative of a mental fatigue network independent of disease pathology.

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**S.F. LONG, J.A. FIELDS, A.L. HESTER, M. CULLUM, L.H. LACRITZ, M. WEINER, L.S. HYNAN & G. ALLEN. Functional Connectivity of Entorhinal Cortex in Alzheimer's Disease.**

**Objective:** In Alzheimer's disease (AD), there is accumulation of neurofibrillary tangles and neuritic plaques and widespread disruption of cortical connections. The entorhinal cortex (EC), which is important in memory processing, has been identified as the first structure affected in AD. The current study investigated the functional connectivity of the EC in AD and normal control (NC) subjects.

**Participants and Methods:** Functional connectivity magnetic resonance imaging (fcMRI) was used to examine significant spontaneous fluctuations in neural activity in differing brain regions that correlate during the resting state. Nine NC and seven AD subjects, selected to be similar in age and education, were imaged in a 3.0 Tesla scanner. The average left EC time course was cross-correlated with all other voxels in the brain.

**Results:** AD subjects exhibited significantly reduced functional connectivity between the EC and prefrontal cortex, right superior temporal areas, right fusiform gyrus, and right perirhinal/entorhinal cortex and hippocampus. Areas of significantly increased connectivity in AD subjects included bilateral inferior frontal gyrus, left middle frontal gyrus, left entorhinal/parahippocampal cortex, and left putamen.

**Conclusions:** The findings of reduced EC connectivity in frontal and temporal association areas in AD are consistent with what is known about the progression of pathophysiology in AD. Increased EC connectivity in prefrontal cortex may reflect the presence of compensatory mechanisms. These results provide support for the use of fcMRI in examining cortical connectivity patterns in AD.

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**B.C. McDONALD, A.J. SAYKIN, J.D. WEST, J.E. SULLIVAN & J.A. DETRE. Medial Temporal Lobe fMRI Activation During Episodic Memory Processing in Children.**

**Objective:** Medial temporal lobe (MTL) structures are crucial for learning and memory, particularly encoding of new information and novelty detection. Prior fMRI research in adults has demonstrated activation of MTL circuitry during episodic memory encoding and retrieval for both verbal and nonverbal stimuli, but such studies have not been conducted in children. Our goal was to determine if activation of MTL circuitry could also be detected in children using fMRI episodic memory probes previously shown to activate these regions in adults.

**Participants and Methods:** To date, nine healthy children (ages 8-12, five males) have been scanned while performing measures of verbal and nonverbal episodic memory. Participants were screened for potentially confounding medical, psychiatric, or learning disorders or medications. fMRI episodic memory probes included blocked visual scene encoding and recognition and event-related auditory-verbal continuous performance recognition memory tasks. Activation in atlas-defined MTL regions of interest, including hippocampus, parahippocampal gyrus (including entorhinal cortex), and amygdala was analyzed using SPM5.

**Results:** Group analyses demonstrated robust bilateral MTL activation during encoding and novelty detection for both verbal and nonverbal tasks. Patterns of activation showed somewhat more activation in the right MTL for visual and left MTL for verbal information, consistent with previous adult research suggesting material specific hemispheric asymmetry for memory. More focal activation was observed for verbal than nonverbal memory.

**Conclusions:** fMRI episodic memory probes can successfully elicit robust MTL activation in children, providing a useful tool for investigation of disorders with MTL or memory pathology, including temporal lobe epilepsy and traumatic brain injury.

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**K. PERRINE, G. KLEIN, S. SCHNEIDER, A. ETTINGER, P. KINGSLEY & A. MEHTA. Co-Registration of fMRI, Wada Testing, and Cortical Stimulation in Patients with Epilepsy.**

**Objective:** To determine concordance of language sites between fMRI, Wada, and Cortical Stimulation

**Participants and Methods:** Eight consecutive patients to date undergoing dominant hemisphere epilepsy surgery were assessed with fMRI utilizing a naming task and a reading comprehension cloze task contrasted with control tasks of nonsense drawings and random letter sequences, respectively. Seven patients underwent Wada testing with similar naming and reading tasks, and all 8 had cortical mapping with electrical stimulation using the same naming and cloze reading tasks. One patient did not undergo Wada testing.

**Results:** Five of seven patients were left hemisphere language dominant by Wada testing. Of the other two, one patient had naming and reading represented in the left hemisphere but fluency and comprehension represented in the right hemisphere. The other patient showed no mutism and only mild dysnomia following the left ICA injection. Of the 5 left hemisphere dominant patients by Wada, 2 showed right hemisphere language activation with fMRI despite no aphasia following right ICA injection. All 5 showed positive language sites with left temporal cortical stimulation, but only 3 patients showed sites concordant between fMRI and stimulation. The one patient without Wada testing showed a right frontal naming site that corresponded with intraoperative cortical stimulation. Only one of the two mixed language patients showed any concordance between fMRI and cortical stimulation sites using the same tasks. fMRI can show sites that are activated with language tasks, but these sites may not be necessary or sufficient for language as demonstrated by cortical stimulation.

**Conclusions:** Reliance on fMRI results can result in both false positive and false negative findings for language.

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**P. PLENGER & K. KOWALSKE. Functional Near Infrared Spectroscopy (fNIRS) Correlates of Recovery of Executive Functioning Following TBI: A Preliminary Analysis.**

**Objective:** The relationship of functional near infra-red spectroscopy (fNIRS) measures of relative oxyhemoglobin (oxy-HB) levels in the cerebral cortex to performance on a Stroop task was evaluated across a three week period in individuals with moderate to severe TBI and matched controls.

**Participants and Methods:** Five males with moderate to severe TBI and five controls performed a computerized version of the Stroop task weekly for three weeks. Optical activity was measured from the frontal and bi-temporal areas with a 3x11 array of optic fiber probes (Hitachi ETG-4000). A randomized block design with three congruent and three incongruent blocks was employed. The number of Stroop errors and percent change in oxyhemoglobin (averaged across respective blocks) were obtained.

**Results:** A series of paired and independent-samples t-tests were conducted, controlling for experiment-wise error rate. Relative activation for each of 52 channels was calculated. TBI patients demonstrated significantly less activation in channels covering the frontal regions during interference trials of the Stroop in addition to a greater number of errors during the first week. Neither of these between group differences was significant by the third week. While patients demonstrated both a significant reduction in errors and a significant increase in frontal oxy-HB from the first to the third week, no significant changes were noted for controls. No significant differences were obtained for any comparisons of temporal activation.

**Conclusions:** The present study indicates that fNIRS may be a reliable and useful methodology for measuring change in cerebral functioning associated with recovery following TBI.

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**K.N. SARGENT, D.L. ROBINS & T.Z. KING. Analysis of Head Movement in MRI Training and Subsequent fMRI Scans.**

**Objective:** Head movement during fMRI scanning causes noise in the data and artifacts in brain activation (Friston et al., 1996). Pediatric and clinical populations are known for having excessive movement during fMRIs (Durstun et al., 2003). The goal for using MRI training, also called mock scanning, is to help train participants to comply with task demands and lie still longer during neuroimaging protocols.

**Participants and Methods:** Three female participants (aged 10, 11, and 21) successfully completed a training session with stringent criteria and subsequent fMRI scan. Three age-matched control participants (aged 10, 10, and 17; one male) completed less training and subsequent fMRI scan. Nonparametric Wilcoxon rank sums were used to compare the head movement of both groups.

**Results:** Preliminary comparison of these three pairs showed that participants' range of movement was significantly smaller in the y- and z-axes ( $p$ 's = .05) during stringent training. Effect sizes were large across all axes and rotations ( $r$ 2s > .55). Preliminary data also reflect that those who completed more stringent fMRI training have a substantially lower overall range of head movement during subsequent scans ( $p$  = .05). Movement along the y-axis was particularly improved during actual fMRI scans ( $p$  = .05). Additionally, all but one movement type (y-axis rotation, "pitch") had large effect sizes ( $r$ 2s > .45).

**Conclusions:** Large effect sizes from our preliminary data suggest that stringent fMRI training is effective in reducing motion during neuroimaging. It is expected that further investigation of fMRI training will confirm its effectiveness as more participants' data are collected.

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M. SCHALLMO, S.L. WRIGHT, H.M. LEON, A.M. KADE, L.M. GUIDOTTI, E.M. BRICENO, M.N. STARKMAN, D.E. SCHTEINGART, B. GIORDANI & S.A. LANGENECKER. **Papez Circuit Activation Observed with Functional Imaging During Semantic List Learning in Controls.**

**Objective:** Word list learning tasks often indicate that greater hippocampal volume and activation correlate positively with subsequently recalled words. Therefore, we hypothesized that significant activation would be observed in the hippocampus in response to subsequently recalled words, but not words that were forgotten, during word list learning (encoding).

**Participants and Methods:** Eleven female and thirteen male control participants completed a Semantic List Learning task during fMRI. Subjects were between 17 and 70 years ( $M=41$ ) and had between 12 and 20 years of education ( $M=16$ ). Fifteen different lists of 14 semantically related words were presented during the scan, and to minimize rehearsal and recency effects, a Brown-Peterson paradigm was implemented. Silent free recall blocks were also used. Recall was conducted later with semantic cues, outside the scanner.

**Results:** Preliminary behavioral data analysis has shown that individuals perform with 36.67% accuracy in recall, with a significant primacy effect ( $F(2,22)=5.955$ ,  $p=.009$ ) being observed. Preliminary fMRI data analysis suggested significant activation in bilateral hippocampus, middle insula, fornix, mammillary bodies, and mid-cingulate for words that were later correctly recalled after scanning. Rostral anterior cingulate and occipital activation were present for words that were later not recalled.

**Conclusions:** Increases in much of the Papez circuit, predominated by hippocampal and insula activity occur during word list learning in response to words that are later recalled, but not words that are forgotten. This confirms well-known associations between this circuit and successful memory encoding and later recall, providing a mechanism for understanding conditions where these circuits are damaged or disrupted. Correspondence: *Michael-Paul Schallmo, University of Michigan, 30206 Barwell Rd., Farmington Hills, MI 48334. E-mail: mschallm@med.umich.edu*

D.M. SMITH, C. FARACO, K. MASON & L.S. MILLER. **Pilot: Using fMRI and neuropsychological tests to index brain function and intellectual abilities following a history of multiple concussions.**

**Objective:** The purpose of this experiment is to use functional MRI (fMRI) to identify blood oxygen level dependent (BOLD) changes in brain function associated with concussive injuries; assess the relationship between fMRI BOLD activity and neurocognitive performance; and investigate the relationship between fMRI BOLD activity and symptom permanence in athletes with a history of multiple concussions.

**Participants and Methods:** Three right-handed male student-athletes between the ages of 18 and 23 with a history of multiple concussions, along with three age-matched controls with no history of concussive injuries were recruited for this study. Participants were given four fMRI tasks (O-SPAN, Stroop, Speeded Sequential Motor, and Retinal Photostimulation) as well as two neuropsychological tests (WTAR and RBANS). Behavioral data was acquired using E-Prime 2.0 software, and the functional data was acquired using a 3T GE Signa HDX Magnetic Resonance System. All fMRI data was analyzed using Statistical Parametric Mapping 5 (SPM5).

**Results:** On average, the experimental group exhibited greater overall fMRI activation in task-specific regions when compared to matched controls. Control versus experimental task results are as follows: O-SPAN- 88.8% vs 72.6%, Stroop- 96.4% vs 92.7%, RBANS- 105 vs 98.3, respectively. Additionally, behavioral data indicated participants with a history of multiple concussive injuries had a greater Stroop effect and a slower response time on the O-SPAN task than did matched controls. Both groups scored similarly on the WTAR.

**Conclusions:** The data suggests that sustaining multiple concussive injuries can have long term effects on neurocognitive abilities as well as on fMRI defined brain function.

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L.H. SWEET, J. MACKILLOP, L. WEIR, S.P. DAVID, B.A. JERSKEY, R.C. MULLIGAN, L. RAY, R.A. COHEN & R.S. NIAURA. **Brain Response to Smoking Cues and Relationships to Severity of Nicotine Dependence.**

**Objective:** Cue reactivity (CR) paradigms have been used to elicit craving, assess dependence severity, and predict treatment outcome. Brain responses to CR may yield markers of nicotine dependence and a better understanding of the neural mechanisms involved.

**Participants and Methods:** Fifteen adult smokers (67% male, mean cigarettes/day=21, mean Fagerstrom score [FTND]=6.42) completed a visual CR paradigm during fMRI. Four blocks of each, smoking images, neutral images, and rest were presented. Analyses were conducted in six region of interest (ROI) engaged by the task, followed by three bilateral a priori ROIs.

**Results:** Images elicited greater activity in the bilateral occipital lobe, left inferior gyrus, and right cerebellum, and deactivation in the bilateral cuneus ( $t>\pm 4.63$ ,  $p<.05$  corrected). Compared to neutral images, less cue-related activity was observed in the left inferior frontal gyrus ( $t=-3.608$ ,  $p=.003$ ) and right cerebellum ( $t=-2.973$ ,  $p=.010$ ), while less cue-related deactivation was observed in left ( $t=2.244$ ,  $p=.042$ ) and right ( $t=2.569$ ,  $p=.022$ ) cuneus. Only cerebellar activity related to severity (cigarettes/day  $r=-.558$ ,  $p=.031$ ; FTND  $r=-.489$ ,  $p=.064$ ).

Among a priori ROIs the left nucleus accumbens (NA) exhibited significantly ( $t=2.336$ ,  $p=.035$ ) greater activity and the left insula tended to exhibit less activity ( $t=-2.029$ ,  $p=.062$ ) during the smoking cues. Activity in the left NA ( $r=-.572$ ,  $p=.026$ ) and left insula ( $r=.611$ ,  $p=.016$ ) exhibited significant relationships with cigarettes/day. There was a trend for this in the right insula ( $r=.495$ ,  $p=.060$ ). The left NA also exhibited a positive relationship with FTND ( $r=.550$ ,  $p=.034$ ).

**Conclusions:** The left NA and bilateral insula are sensitive to smoking cues. The magnitude of these responses are indicators of dependence severity.

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V. WEISSER, A. MERZAGORA, M. SCHULTHEIS & B. ONARAL. **Neuroimaging in Neuropsychology: Is One Signal Enough?**

**Objective:** Functional near-infrared spectroscopy (fNIRS) is an emerging portable optical technology used to detect hemodynamic activation. A handful of studies have compared the fNIRS and fMRI signal, but fNIRS correspondence to other imaging modalities remains limited. The objective of this study was to examine the relationship between signals obtained from fNIRS and electroencephalography (EEG). A secondary objective was to assess the relationship between resting brain activation and cognition.

**Participants and Methods:** Participants included eight healthy controls and two individuals with acquired brain injury (mean age 26.4 years). All participants were administered tests of attention (CPT) and inhibition (Stroop). fNIRS and EEG signals were simultaneously recorded, and signals during resting state period were extracted separately for the left and right frontal lobes. Neuroimaging measures included oxygenated and deoxygenated blood volume levels (fNIRS) and alpha power (EEG).

**Results:** Pearson correlations were used to assess the relationships between the signals and cognitive tests. No significant correlations were seen between the fNIRS and EEG signals. Correlations with neuropsychological tests revealed contrasting patterns. Deoxy-fNIRS was negatively correlated with neuropsychological performance whereas EEG alpha was positively correlated. For CPT, a significant negative correlation was found between commission errors and left frontal alpha power ( $r=-.72$ ). For Stroop, a significant negative correlation was found between word reading and right frontal fNIRS deoxygenation ( $r=-.71$ ).

**Conclusions:** These preliminary results underscore the differences in brain activation measures obtained by using multiple neuroimaging tools, and considering how these signals provide complementary evidence of neurological function is warranted. Data collection and analysis is ongoing.

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## Imaging (Structural)

### R. BRAHMACHARI, A.E. MOLNAR, M.Y. KIBBY & G.W. HYND. Cingulate Gyrus Volume and Emotional/Behavioral Problems: A Structural MRI Study.

**Objective:** Children with learning disabilities and AD/HD frequently have comorbid internalizing and/or externalizing problems. Furthermore, reduced cingulate gyrus volume has been associated with emotional problems, despite the fact that it is rarely studied in dyslexia. Hence, the goal of this study was to assess the relationship between cingulate volume and severity of internalizing and externalizing problems in children with dyslexia and/or AD/HD.

**Participants and Methods:** Data were obtained from a larger study on dyslexia and AD/HD (NIH R01 HD26890). Data analysis and write-up were supported by a separate grant (NIH R03 HD048752). Forty children, ages 8-to-12 years, completed a neuropsychological battery and a MRI scan: 14 had dyslexia, 8 had comorbid dyslexia and AD/HD, 10 had AD/HD, and 8 were controls. The cingulate gyrus was traced on every slice in the sagittal plane using modified guidelines from Buchanan et al. (2000). Inter-rater reliability was  $> 0.90$ .

**Results:** As groups did not differ in cingulate volume when using a 2 X 2 MANCOVA controlling for cerebral hemisphere volume, Pearson correlations were run on the total sample in an exploratory fashion. Smaller left cingulate volume was moderately associated with worse RCMAS Worry/Oversensitivity and Teacher BASC Withdrawal, Depression, and Aggression. Leftward asymmetry of the cingulate was moderately associated with worse RCMAS Worry/Oversensitivity and Physiological anxiety and Teacher BASC Withdrawal, Depression, Aggression and Conduct Problems.

**Conclusions:** As most prior research has analyzed right anterior cingulate volume specifically in relation to emotional functioning, further research is indicated on the relationship between other parts of the cingulate gyrus and emotional/behavioral functioning.

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### T.G. BURNS, D.L. ILARDI, J. GRAHAM, R. JONES, G. KIRK, A. SUTTON & W. HAMILTON. Prefrontal Cortical Thinning in Children with Sleep Disordered Breathing Predicts Executive Dysfunction.

**Objective:** Sleep disordered breathing (SDB) is linked to various cognitive and behavioral disturbances in children (Bass et al, 2004). While previous research has linked cognitive deficits with SDB, the present study posited that neuroanatomical data (Voxel Based Morphometric analyses) would relate to executive dysfunction in children with SDB.

**Participants and Methods:** Participants included 25 children (14 females; ages 8-14) diagnosed with sleep disordered breathing (SDB) and 13 healthy controls. Measures included the Behavior Rating Inventory of Executive function (BRIEF), Tower of London-DX, and Delis-Kaplan Executive Functioning System (DKEFS) Color Word (CW) and Verbal Fluency (VF) subtests. Voxel-Based Morphometry was utilized to measure cortical thickness in two regions of interest in the prefrontal cortex.

**Results:** Independent t-tests revealed the SDB group had lower performance on the DKEFS-CW inhibition ( $p < .05$ ), color ( $p < .01$ ), word ( $p < .05$ ), DKEFS-VF letter ( $p < .01$ ), and BRIEF Behavior Regulation (BRI;  $p < .05$ ) and Metacognition Indices (MI;  $p < .05$ ), as well as cortical thinning for both regions ( $p < .01$ ). Prefrontal cortical thinning was associated with more difficulty on DKEFS-CW inhibition, ( $p < .05$ ), color ( $p < .05$ ), word ( $p < .05$ ), BRIEF-BRI ( $p < .05$ ) and BRIEF-MI ( $p < .05$ ). Cortical thinning as a moderator between SDB and executive dysfunction will be delineated.

**Conclusions:** Results indicate that children with SDB, compared to normals, have lower performance on measures of executive function. Prefrontal cortical thinning was also related to executive dysfunction. Results support the hypotheses that neuroanatomical regions in children with SDB correlate with neurofunctional deficits on measures commonly used in clinical neuropsychology.

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### D. COBIA, J. GFELLER, D. LAVOIE & J. CSERNANSKY. Relationships Between Cortical Thickness and Verbal Working Memory in Schizophrenia.

**Objective:** Working memory deficits are prevalent in schizophrenia and increasingly considered a prominent feature of the cognitive aspects of the disease. Structural MRI research has implicated prefrontal, temporal, and parietal cortical regions in working memory processes, but the information has been limited to region of interest analyses and inconsistent results. Using a novel whole brain analysis approach, it was hypothesized that variation in the cortical thickness of regions known to support working memory would correlate with working memory performance in healthy subjects, but that this pattern would be disturbed in schizophrenia subjects.

**Participants and Methods:** 67 healthy and 67 schizophrenia subjects were recruited from a longitudinal study at a major medical center. Groups were similar with respect to age, gender, handedness, and parental SES, but did differ on race and education. Verbal working memory was defined using the Digit Span Backwards and Letter-Number Sequencing subtests from the WAIS-III. Cortical thickness was derived using the imaging analysis suite FreeSurfer.

**Results:** Schizophrenia subjects performed poorly on measures of verbal working memory, when compared to healthy participants. A stepwise regression analysis in the healthy group revealed that ventrolateral prefrontal and medial occipital cortices best explained verbal working memory performance. In the schizophrenia group, medial orbital prefrontal cortex was the greatest predictor of verbal working memory. Race and level of education also influenced the regression models.

**Conclusions:** Results suggest that the structural correlates of verbal working memory differ in healthy individuals compared to those with schizophrenia. Prefrontal regions play a role, but not the extent typified by functional studies. Race and level of education were unexpected influential variables that should be considered in future research.

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### S. EPSTEIN, S. CORREIA, A. MACKAY-BRANDT, D. LAIDLAW, P. MALLOY & S. SALLOWAY. Superior longitudinal fasciculus and working memory in CADASIL.

**Objective:** To examine the structural integrity of the superior longitudinal fasciculi and its relationship to working memory in patients with Cerebral Autosomal Dominant Arteriopathy with Subcortical Infarcts and Leukoencephalopathy (CADASIL).

**Participants and Methods:** Twelve patients with CADASIL and ten healthy controls underwent MRI including diffusion-tensor imaging (DTI) and cognitive assessment including a verbal n-back test. Grey matter, white matter, intracranial, and subcortical hyperintensity (SH) volumes were measured. Quantitative DTI tractography was used to assess the structural integrity of the superior and inferior longitudinal fasciculi (SLF, ILF) bilaterally and the genu and splenium of the corpus callosum.

**Results:** The groups did not differ significantly by age or education. The CADASIL group had higher SH volume ( $p = .012$ ) and reduced structural integrity ( $p < .026$ ) in the SLF bilaterally but not the left ILF, and in the splenium but not the genu of the corpus callosum. The CADASIL group had poorer performance at higher (2- and 3-back,  $p < .022$ ) but not lower (0- or 1-back) working memory loads. The groups did not differ on task with minimal working memory demands (confrontational naming). In the whole sample, 2-back performance was correlated with white matter integrity of the right SLF ( $r = .461$ ,  $p = .031$ ) and left SLF ( $r = .513$ ,  $p = .015$ ) but the right ILF or splenium.

**Conclusions:** White matter integrity and working memory are reduced in CADASIL. The results support a role for the SLF in working memory and provide support for the utility of quantitative tractography for exploring the cognitive correlates of specific white matter tracts in healthy and clinical populations.

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**V. ELDERKIN-THOMPSON, D. PHAM, G. HELLEMANN & A. KUMAR. Does Mild Prefrontal Atrophy Affect Functioning of Healthy and Depressed Elderly?**

**Objective:** Lesion analysis tells us that loss of prefrontal tissue has behavioral implications, but little research has focused on the effects of non-traumatic loss of tissue volume among elderly individuals. Research from our laboratory identified three prefrontal paralimbic regions with significant loss of volume with depression - the anterior cingulate, gyrus rectus and orbitofrontal cortex. The three regions are important for frontostriatal and limbic connectivity in the prefrontal cortex. We examined the associations between executive performance and self-perceived daily functioning and the volumetric loss associated with natural aging and with late-life depression.

**Participants and Methods:** Healthy (N=41) and depressed elderly (N=43) individuals underwent magnetic resonance imaging, a panel of laboratory tests, a daily functioning questionnaire and neuropsychological evaluation. Images of the prefrontal cortex were manually masked and automatically segmented and regional brain volumes calculated. Functional and cognitive measures were correlated with regional indices.

**Results:** White and gray matter of specific regions were associated with selective executive measures, and the relationship was usually stronger among healthy elderly than depressed elderly. Anterior cingulate and gyrus rectus volumes were associated with visuospatial performance and response suppression, but orbitofrontal volumes were associated with both correct responses and errors on fluency tasks. Behaviorally, white matter volumes were associated with self-perceived energy levels and gray matter with perceived health status. The association between self-perceived health status and prefrontal volumes was particularly strong among depressed individuals.

**Conclusions:** Mild atrophy is expected in late-life, and it becomes exacerbated among patients with depression. The magnitude of atrophy in paralimbic structures appears to qualitatively modulate self-perceptions of health and quantitatively modulate executive capabilities.

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**B.C. EMERTON, M. JERRAM, T. DECKERSBACH, C. FULWILER & D.A. GANSLER. America's next top method? Comparing voxel-based morphometry and volumetry.**

**Objective:** Digital MRI analysis methods allow in vivo examination of neuroanatomical morphological characteristics (e.g. volume) to study brain-behavior relationships. The assumption that voxel-based morphometry (VBM), offers an automated substitution for manually-traced volumetry, the "gold standard" in volumetric research, was empirically evaluated. Data from a previous volumetry study of orbitofrontal (OFC) correlates of aggression (Gansler et al., in press) provided the basis for this study, which assessed for methodological convergence.

**Participants and Methods:** Gray matter (GM) volume and self-reported aggression associations were tested using VBM and volumetry in forty adult psychiatric patients. Participants underwent brain MRI and completed the Lifetime History of Aggression Scale Revised (LHA). VBM was conducted in SPM2 per an optimized modulated protocol. Using a regression model, partial correlations (controlling scanner type) of GM volume and LHA scores were tested at each voxel ( $p \leq 0.005$ , uncorrected). For volumetry, the OFC was traced coronally in Medx using an established protocol with acceptable interrater reliability. Parallel associations of left (L) and right (R) OFC volume and LHA scores (controlling scanner) were tested.

**Results:** Both methods revealed significant negative associations of L OFC volume and aggression and no significant relations for R OFC. VBM also detected a positive L OFC association.

**Conclusions:** Results indicate methodological convergence, demonstrating the same hemispheric findings for each method. VBM also yielded additional data not detected with volumetry indicating VBM allows greater within-region localization. However, the methods differentially deal with error rates and power demands and as such are better conceptualized as complementary than interchangeable.

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**R.L. ENGLAND, R.E. JUNG, A. CAPRIHAN, H.J. BOCKHOLT, R. BARROW, R. CHAVEZ, S. SMITH, J.M. SEGALL & R.A. YEO. The relationship between white matter tract microstructure and personality traits: a DTI study.**

**Objective:** Using diffusion tensor imaging, we investigated the relationship between the integrity of white matter tracts and personality traits, namely neuroticism (N) and extraversion (E). Specifically, the cingulum (CING) and uncinate fasciculus (UF) were a focus of this study.

**Participants and Methods:** Forty-five healthy participants were administered the NEO-PI-R. All images were acquired on a 1.5 T Siemens scanner system. A diffusion-weighted, spin-echo, echo-planar imaging (EPI) scan was acquired in 12 directions. Maps of fractional anisotropy (FA) and mean diffusivity (MD) were then created. Next, 3D tract reconstruction was created for the left and right UF and CING. Once each tract was identified, an average FA and MD value was obtained for the entire tract.

**Results:** Pearson's correlations were used to examine the relationship between average FA and MD for each tract with E and N. A significant inverse relationship was detected between E and MD for the left UF ( $r = -0.391$ ,  $p = 0.032$ ) and the left CING ( $r = -0.391$ ,  $p = 0.008$ ). A significant positive relationship was detected between N and MD for the right CING ( $r = 0.369$ ,  $p = 0.013$ ). No significant relationships were detected with FA.

**Conclusions:** Findings imply that facilitated communication between prefrontal and temporal areas via the UF and CING is related to increased E. By contrast, reduced communication between prefrontal and temporal areas via the CING is related to increased N. Results provide insights into the mechanism by which E and N may be supported in the brain. Specifically, divergent patterns of brain lateralization and degree of connectivity via white matter tracts appear relevant.

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**J.Y. JANG, V. LALUZ, C.M. STANLEY, S. GLENN, J.H. KRAMER, B.L. MILLER & K.P. RANKIN. Neuroanatomy of Empathy: Sub-lobar Volumes of Right Fronto-temporal Networks.**

**Objective:** Previous studies suggest right fronto-temporal networks mediate empathy. However, structural studies with neurodegenerative disease patients have used exploratory, whole-brain methods like voxel-based morphometry to statistically infer brain-behavior relationships. No large-scale study has yet examined empathy's structural neuroanatomy by directly measuring sub-lobar volumes.

**Participants and Methods:** Informants described 179 participants (56 frontotemporal lobar degeneration, 56 Alzheimer's, 9 corticobasal degeneration, 14 progressive supranuclear palsy, 44 normal older controls) using the Interpersonal Reactivity Index (IRI), a questionnaire measure of empathy. Sub-lobar volumes were measured on subjects' 1.5T structural scans using an automated Freesurfer routine. Ten right frontal, 7 temporal, 4 subcortical, and 1 inferior parietal sub-lobar volumes were compared using an Allen-Cady backward regression procedure to determine if any ROIs independently predicted empathic concern (EC) or perspective taking (PT) subscales of the IRI.

**Results:** Controlling for age, sex, and total intracranial volume, 28% of the variance in EC was accounted for by volumes of inferior parietal

gyrus ( $p < 0.01$ ), middle ( $p < 0.01$ ) and inferior temporal gyri ( $p < 0.05$ ), medial orbitofrontal gyri ( $p < 0.05$ ), and right accumbens area ( $p < 0.001$ ). Twenty-two percent of PT variance was accounted for by the rostral middle frontal gyrus ( $p < 0.05$ ), amygdala ( $p < 0.05$ ), and accumbens area ( $p < 0.001$ ) volumes. No other region, including temporal pole or anterior cingulate, was significant.

**Conclusions:** These findings augment existing evidence that right temporal structures are preferentially engaged in emotional components of empathy, whereas right frontal structures mediate cognitive empathy. Also, the very strong relationship between atrophy in the nucleus accumbens and loss of empathy suggests that empathy may recruit reward circuitry.

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**J. JURANEK, M. PRASAD, L. KRAMER & L. EWING-COBBS. Association Between Amygdala Volume and Self-Reported Measures of Anxiety in Children with TBI.**

**Objective:** Few studies have investigated brain-behavior relationships in children with Traumatic Brain Injury (TBI). While it is clear that survivors of TBI are particularly susceptible to the development of psychiatric disorders relative to typically-developing counterparts, the neurobiological bases of this increased risk is currently poorly understood. The present study was undertaken to investigate the relationship between self-reported measures of anxiety and brain volume in child survivors of TBI. We hypothesized that amygdala volume would be increased in TBI children with elevated scores on measures of anxiety.

**Participants and Methods:** High resolution T1-weighted MR images were acquired on a Philips 3T scanner 2 months following injury and automatically segmented into gray matter, white matter, and CSF using Freesurfer v4.0.5 software. Subcortical structures, including the amygdala, were segmented and volumetric data were quantitatively reported. After correction for individual differences in total brain volume, amygdala volumes were then related to measures of anxiety as assessed by the Screen for Child Anxiety Related Disorders (SCARED).

**Results:** In both boys and girls, average amygdala volume (corrected for eTIV) was increased in subjects with higher scores of social anxiety. Other subscales of the SCARED (e.g. somatic symptoms, school avoidance, separation anxiety, and generalized anxiety) did not demonstrate similar results. These preliminary findings suggest that increased amygdala volume may be specific to increased social anxiety in child survivors of TBI at 2 months post injury.

**Conclusions:** Increased amygdala volume is associated with increased self-report measures of social anxiety in child survivors of TBI at 2 months post injury.

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**A.K. LEE, B.C. EMERTON, M. JERRAM, T. DECKERSBACH, R. BHADELIA, C. FULWILER & D.A. GANSLER. Neural Correlates of Aggression: A Voxel-Based Morphometry Study.**

**Objective:** Empirical evidence supported the role of orbitofrontal cortex and amygdala in the modulation of aggression. The somatic marker hypothesis, which suggests emotions and physiology as important guides for decision making, provides a useful framework for interpreting aggression as a product of poor decision making, arising from disruption of the frontal-parietal-limbic network. However, recent whole brain analyses of psychopaths revealed brain abnormality that extended to the temporal lobe. The current study examines the neural correlates of aggression using Voxel-based Morphometry (VBM), with a particular interest in the network implicated by the somatic marker hypothesis and beyond.

**Participants and Methods:** We studied 40 (35 men) psychiatric patients with a mean age of 39.95 (SD=8.3) and 10.8 years (SD=2.9) of education. Participants completed the Life History of Aggression Scale Revised. Brain MRIs were obtained from 1.5T scanners and processed with SPM2 following a modulated optimized VBM protocol.

**Results:** A whole-brain voxel-wise regression of aggression, controlled for scan types, was performed. At  $p \leq .005$  (uncorrected), aggression was primarily a positive predictor of right parietal volumes, and a negative predictor of bilateral frontal and temporal volumes.

**Conclusions:** The relationship of aggression with the ventral frontal and right parietal regions could be accounted for by the somatic marker hypothesis. Notably, the association of aggression to the lateral temporal and dorsal frontal regions converges with studies on psychopaths, and suggests that aggression is not only attributable to disruption in the decision-making process, but also possibly to deficits in the Theory of Mind and empathy, which are instantiated in the frontal-temporal network.

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**G. LOCASCIO, A. GINTY, D. CROCKETT, S.H. MOSTOFKY, K. RUBLE, C.L. SCHWARTZ & E.M. MAHONE. Rostral Corpus Callosum Size is Associated with Motor Performance in Survivors of Childhood Leukemia.**

**Objective:** Treatment with infusional and intrathecal chemotherapy has replaced radiation therapy in many children with acute lymphoblastic leukemia (ALL); however, there is accumulating evidence of frontal white matter disruption in these patients. To date, there have been few studies examining corpus callosum (CC) development in survivors of childhood ALL who have not been treated with radiation therapy. We hypothesized that survivors of ALL would have anomalous CC development, particularly among anterior CC regions, and that these differences would be associated with motor performance.

**Participants and Methods:** Participants included 14 children with ALL and 14 controls, ages 8-18. Children in the ALL group were diagnosed after age 12 months, were more than 5 years from diagnosis, free from disease recurrence, and treated with infusional and intrathecal chemotherapy, but not radiation therapy. MRIs were acquired on a 1.5-T GE scanner. T1-weighted sagittal series were obtained and CC and intracranial areas (ICA) manually delineated from midsagittal slice. CC area was segmented into five regions (genu, rostral body, midbody, isthmus, splenium). Motor assessment included 12 timed tasks from the PANESS (Denckla, 1985).

**Results:** There were no significant differences in age, FSIQ, or ICA between groups. After controlling for ICA and age, the ALL group had a marginally significant decrease in rostral body area ( $p = .07$ ,  $\eta^2 p = .13$ ). Within the ALL group, rostral body area was significantly correlated with left toe-tapping speed, and left-right motor speed asymmetries on hand patting and finger-sequencing.

**Conclusions:** Treatment with chemotherapy for childhood ALL may be associated with anomalous anterior CC development, resulting in reduced timed motor performance.

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**A.E. MOLNAR, R. BRAHMACHARI, M.Y. KIBBY & G.W. HYND. Orbitofrontal Volume in Relation to Executive Functioning In Dyslexia and ADHD.**

**Objective:** Research suggests a relationship exists between orbitofrontal (OF) dysfunction, executive dysfunction, and poor impulse control. However, the potential relation between OF structure and executive functioning (EF) in children with dyslexia and ADHD remains unexplored. Therefore, the purpose of this study was to examine the relation between OF size and measures of EF in children with dyslexia and/or ADHD and controls.

**Participants and Methods:** Data were collected through a study focused on dyslexia and ADHD (NIH R01 HD26890). A separate grant (NIH R03 HD048752) supported data analysis and write up. Participants include 40 children, ages 8 to 12 years, who completed a neuropsychological battery and a MRI scan: 10 with ADHD, 14 with dyslexia, 8 with comorbid dyslexia/ADHD, and 8 controls. The OF was traced on every other slice in the coronal plane based on the work of Buchanan et al. (2000). Inter-rater reliability was high ( $> 0.90$ ).

**Results:** A 2 (dyslexia vs. no dyslexia)  $\times$  2 (ADHD vs. no ADHD) MANCOVA was conducted controlling for cerebral hemisphere volume, and groups did not differ in OF volume. However, children with dyslexia (dyslexia, ADHD/dyslexia) had greater rightward asymmetry of the OF region compared to children without dyslexia (ADHD, controls),  $F(1, 39) = 9.35, p < .01$ . Pearson correlations using the total sample revealed moderate relations between right OF volume and Teacher BASC Hyperactivity and WCST Perseveration.

**Conclusions:** As differences were found in OF asymmetry in dyslexia and OF volume was related to EF, future research should examine OF structure in dyslexia and its relation to EF.

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**J.N. PORTER, P.F. COLLINS, R.L. MUETZEL, K.O. LIM & M. LUCIANA. Cortical Maturation and Verbal Fluency in Childhood, Adolescence, and Young Adulthood.**

**Objective:** Neuroimaging studies of normative human brain development indicate that brain matures at differing rates across time and brain regions, with some areas maturing into young adulthood. T1-weighted high-resolution structural magnetic resonance imaging (sMRI) allows for a detailed morphometric analysis of changes in cortical grey matter. In particular, changes in cortical thickness may index maturational progressions from an overabundance of neuropil to efficiently pruned neural networks. These changes have rarely been associated with neuropsychological functions.

**Participants and Methods:** In this study, healthy right-handed adolescents ( $n=173$ , ages 9-23 years, MDN=17.4 years) completed sMRI scanning and a series of neuropsychological tests, including the Controlled Oral Word Association Test (COWAT) and a set-shifting variant of the COWAT. These tasks have well-validated neural correlates. Age-related and age-independent associations of performance measures on both tasks with cortical thickness were assessed with cortical surface-based analyses.

**Results:** Significant negative correlations between COWAT performances and cortical thickness were found in regions corresponding to left hemisphere language regions, including Wernicke's and Broca's areas. Significant right hemisphere regions included frontal and parietal areas associated with effortful verbal and working memory processing. Independent of age, thinner cortex in these areas was associated with increased task performance. Developmentally, structure-function associations were stronger in older compared to younger subjects.

**Conclusions:** Cortical thickness decreases in regions that comprise the language network likely reflect maturation toward adult-like cortical organization and processing efficiency. Changes in brain structure that support these commonly used measures of executive function appear to be reached in the late teens, consistent with other studies of frontal lobe development.

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**D. LANHAM, S.L. RIMRODT, L.E. CUTTING & P. BARKER. Neurochemical Correlates of Reading Disability in Children.**

**Objective:** MR Spectroscopy imaging (MRSI) measures micro-concentrations of specific neurochemicals, N-Acetylaspartylcholine (NAA), Creatine (Cr) and Choline (Cho). Relative concentrations of NAA, a

marker of neuronal/axonal health, are frequently reported as ratios (NAA/Cr, NAA/Cho). Spectroscopy results of individuals with reading disability (RD) have suggested linkages to NAA ratio abnormalities. The current study used MRSI to identify differences in metabolic concentrations across a group of children with and without RD.

**Participants and Methods:** Participants were twelve children, 6-11 years old, with a wide range of reading ability; six of these children also had a genetic disorder associated with RD in approximately 50% of patients, i.e., Neurofibromatosis Type-1 (NF-1). MRSI ratios and reading measures (WIAT Basic Reading (WIAT-BR) and WJ Word Attack (WJ-WA)) were obtained; statistical analyses included correlations of reading measures to NAA ratios.

**Results:** Spearman Rho non-parametric correlational analyses revealed significant associations of NAA ratios to reading measures: (1)NAA/Cr positively correlated to WIAT-BR in cerebellum (right hemisphere:  $r=+0.733;p=.025$ ; left hemisphere:  $r=+0.833;p=.010$ ) and thalamus (right hemisphere:  $r=+0.585;p=.046$ ; left hemisphere:  $r=+0.606;p=.037$ ), and negatively correlated to WJ-WA in left parietal white matter ( $r=-0.6925;p=.0182$ ). (2)NAA/Cho negatively correlated to WIAT-BR in left putamen ( $r=-0.624;p=.040$ ), and to WIAT-BR and WJ-WA in left parietal white matter (WIAT-BR:  $r=-0.647;p=.031$ ; WJ-WA:  $r=-0.679;p=.022$ ).

**Conclusions:** Findings are consistent with reports suggesting patterns of metabolic concentrations across different brain regions are related to reading skill. Furthermore, our data suggests the presence of metabolic abnormalities within left parietal white matter of children with RD, consistent with functional imaging studies proposing abnormalities in a posterior reading circuit.

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**J.L. TAYLOR, M.M. ADAMSON, V. SAMARINA, Q. KENNEDY, J.A. YESAVAGE & M.W. WEINER. Larger Hippocampi Help Expert Pilots Maintain Performance in a Flight Simulator.**

**Objective:** Hippocampal volume plays a role in retention and can predict memory decline in normal older adults. Cognitive reserve suggests that older experts performing tasks in their skill domain may compensate for memory decline by relying on skill-relevant procedural and "semantic-like" memories. In contrast, schemas emphasize the interplay between semantic-like memory and hippocampal-dependent learning. These two models, which make different predictions regarding expertise X hippocampal interactions, were tested in a longitudinal study of pilots.

**Participants and Methods:** 48 aircraft pilots over age 45 ranging in level of aviation expertise (as defined by FAA pilot proficiency ratings) were familiarized with a flight simulator scenario. Three weeks later, participants began annual testing (Year 0, 1, 2) using the flight simulator scenario and CogScreen-AE. The primary outcome was rate of decline in the flight summary score. Aviation expertise, total hippocampal volume, APOE e4 status, and their interactions were used in multiple regression to model individual differences in the rate of decline in simulator performance.

**Results:** At baseline, aviation expertise was associated with better flight summary scores, but not with hippocampal volume, cognitive scores, or APOE e4 status. APOE e4 carriers and non-carriers had similar flight summary scores. Longitudinally, there was a positive expertise X hippocampal volume interaction, such that having larger hippocampi was more important for high-expertise than for low-expertise pilots in maintaining simulator performance over time.

**Conclusions:** These preliminary results are consistent with schemas in which older expert pilot performance depends on medial-temporal lobe integrity and interconnections with other regions subserving aviator performance.

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**S.D. TOWLER, C.C. PRICE, S.M. MITCHELL & D.J. LIBON. White Matter Hyperintensity Quantification in T2 FLAIR MRI: A Reliability Study.**

**Objective:** The present work evaluates the reliability of two methods for quantifying white matter hyperintensities (WMHs) in brain MRIs. Though shown to be valid and reliable, visual rating scales have methodological limitations including: 1) lack of a graphical record of raters' judgments, 2) reliability analyses that cannot evaluate the spatial overlap of repeated ratings, and 3) the inability to capture WMH boundaries for use in spatial analyses of additional MR brain measures. These limitations are solved by creating computerized binary masks from spatial segmentations of WMHs.

**Participants and Methods:** Two expert raters manually segmented WMHs in 15 whole-brain T2 FLAIR MRIs previously scored with the Junque visual rating scale (Junque, 1990). Segmentation was performed using US NIH software (ImageJ: <http://rsbweb.nih.gov/ij/>). Each rater independently segmented each MRI twice in a blind pseudo-random order with non-consecutive repeats.

**Results:** Inter- and intrarater reliability of these WMH segmentations was high: all ICCs > 0.94 ( $p < 0.001$ ), Chronbach's Alpha > 0.98. Means of the Similarity Index, a measure of spatial overlap, were high in all reliability comparisons (grand mean = 0.84,  $sd = 0.12$ ). Junque visual ratings were highly correlated with each set of WMH measures (Spearman's  $\rho > 0.8$ ,  $p < 0.01$ ).

**Conclusions:** This work establishes the reliability of manual WMH segmentation and a visual rating scale previously shown to correlate with clinical and cognitive measures. Unlike visual rating scales, the binary masks produced by manual segmentation can be used to further investigate the tissue properties of WMH regions and their relationship with clinical and cognitive variables. Funded by NINDS K23NS060660(CP), AlzAssociation IIRC0627542(DL)

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**F. WOON & D.W. HEDGES. Alcoholism does not Contribute to Hippocampal Volume Loss in Adults with Posttraumatic Stress Disorder: A Meta-Analysis.**

**Objective:** It is unclear whether alcohol affects hippocampal volume in posttraumatic stress disorder (PTSD). To estimate the effects of alcohol on brain volume in PTSD, we synthesized published studies on the relationship between alcoholism (defined as having a lifetime history of alcohol abuse/dependence) and hippocampal volume in adults with PTSD.

**Participants and Methods:** Using the terms posttraumatic stress disorder, magnetic resonance imaging, hippocampus, and alcohol abuse and dependence, we searched electronic databases for peer-reviewed articles through 2008 containing data for hippocampal volume and the presence or absence of alcoholism in PTSD adults compared to either healthy, trauma-unexposed controls (HC) or healthy, trauma-exposed controls without PTSD (TE), or both. We identified 22 studies with right hippocampal data and 19 studies with left hippocampal data that met inclusion criteria. Differences in hippocampal mean volumes across groups were calculated with effect sizes ( $g$ ) and the presence or absence of alcoholism as a moderating variable.

**Results:** A smaller right hippocampus was found in the analyses of PTSD vs. HC ( $g = -.56$ ,  $p < .0005$ ), TE vs. HC ( $g = -.58$ ,  $p < .0005$ ), and PTSD vs. TE ( $g = -.54$ ,  $p < .0005$ ). Similarly, a smaller left hippocampus was found in the analyses of PTSD vs. HC ( $g = -.57$ ,  $p < .0005$ ), TE vs. HC ( $g = -.40$ ,  $p = .002$ ), but not PTSD vs. TE ( $g = -.21$ ,  $p = .16$ ). However, alcoholism did not moderate hippocampal volume in any comparison ( $p > .05$ ).

**Conclusions:** Hippocampal volumes were smaller in the PTSD and TE groups compared to the HC group; however, these volumetric differences were not moderated by comorbid alcoholism, suggesting that hippocampal volume deficits in PTSD are independent of alcoholism.

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**R. YALLAMPALLI, E.A. WILDE, T.L. MERKLEY, E.D. BIGLER, Z. CHU, G. HANTEN, M. TROYANSKAYA, J.V. HUNTER, X. LI & H.S. LEVIN. Relation of Amygdala Volume and Processing of Visually-Based Emotional Stimuli Using the Face-Emotion Recognition Task in Pediatric Traumatic Brain Injury.**

**Objective:** Traumatic brain injury (TBI) is a common cause of cognitive and behavioral difficulties among children and adolescents, including impairments in socio-emotional processing. We examined correlations between basic visual emotion processing in children with and without TBI and amygdala volume.

**Participants and Methods:** Twelve children (6F/6M) aged 8-16 years (mean = 12.8) with TBI (GCS mean = 8.33) and eight children (3F/5M) of equivalent age with extracranial orthopedic injury (OI) underwent MRI imaging 18 months post-injury (mean = 17.5 months) on a 3T Philips scanner. Groups did not significantly differ in age, ethnicity, post-injury interval, or socioeconomic composite index, and all participants were right handed. All subjects underwent volumetric analysis using Freesurfer software. Subjects were administered the Face-Emotion Recognition task, where they were asked to sort photographs of adult faces according to emotional expression, and then sort according to person and not facial expression. Accuracy and completion time were measured.

**Results:** Spearman correlation analysis showed significant relations between the time for completing the face-emotion task and left ( $r = -0.74$ ,  $p = 0.037$ ) and right amygdala volumes ( $r = -0.83$ ,  $p = 0.010$ ) in the OI control group. Similarly, significant correlations between these variables were present in the TBI group (left:  $r = -0.65$ ,  $p = 0.015$ ; right:  $r = -0.69$ ,  $p = 0.009$ ), with decreased amygdala volume associated with increased time to complete the task.

**Conclusions:** Our results using an automated volumetric analysis program are consistent with other structural and functional imaging studies implicating the amygdala in processing emotional stimuli. Future studies with a larger cohort examining the relation of volumetric analysis to emotional processing are underway.

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**R. YALLAMPALLI, E.A. WILDE, T.L. MERKLEY, E.D. BIGLER, Z. CHU, G. HANTEN, X. LI, M. TROYANSKAYA, J.V. HUNTER & H.S. LEVIN. The Effects of Pediatric Traumatic Brain Injury on Short Term Memory Processing and Hippocampal Volume.**

**Objective:** The hippocampus, as part of a larger distributed neural network is implicated in the processing of short term memory. One of the more common complaints following traumatic brain injury (TBI) is memory impairment. In this study, we looked the relation of volumetric changes in the hippocampi and short term memory processing in children following TBI.

**Participants and Methods:** Twelve children (6F/6M) aged 8-16 years (mean = 12.8) with TBI (GCS mean = 8.33) and eight children (3F/5M) of comparable age, ethnicity, post-injury interval, and socioeconomic composite index underwent volumetric imaging 18 months post-injury (mean = 17.5 months) on a 3T Philips scanner. All participants were right handed. All subjects underwent volumetric analysis using Freesurfer software and were administered the Sternberg Task with the three standard conditions, (memory loads 1, 4, and 6) as well as the Flanker Task, measuring the baseline, facilitation and interference condition reaction time (RT) variables.

**Results:** Spearman correlation analysis revealed relations between the right hippocampus and the Sternberg RT on condition 1 ( $r = 0.64$ ,  $p = 0.026$ ), 4 ( $r = -0.77$ ,  $p = 0.009$ ) and 6 ( $r = -0.71$ ,  $r = 0.010$ ) in the TBI group. In the Flanker task, the left hippocampus moderately correlated with the Flanker baseline ( $r = -0.59$ ,  $p = 0.035$ ), facilitation ( $r = -0.56$ ,  $p = 0.047$ ) and interference condition RT ( $r = -0.52$ ,  $r = 0.072$ ) and the right hippocampus strongly correlated with the Flanker baseline ( $r = 0.88$ ,  $p < 0.001$ ), facilitation ( $r = -0.77$ ,  $p = 0.002$ ) and interference RT ( $r = -0.82$ ,  $r = 0.001$ ) in TBI.

**Conclusions:** Hippocampal volumes were related to short-term memory-based reaction time in TBI, with lower hippocampal volume correlating with longer reaction times. Further studies with a larger cohort are underway to further examine this relation.

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**P. YAU, D. JAVIER, W. TSUI, C. RYAN, B. ARDEKANI, G. JOHNSON, S. TEN & A. CONVIT. Structural and Functional Brain Compositions in Obese Adolescents with Type 2 Diabetes Mellitus.**

**Objective:** Central Nervous System (CNS) abnormalities, including cognitive and brain impairments have been documented in adults with type 2 diabetes mellitus (T2DM), but these individuals also have multiple co-morbid vascular disorders which could contribute to these observations. The increased incidence of T2DM in adolescents provides an opportunity to evaluate the extent to which diabetes per se adversely affects brain function and structure years before the development of significant vascular disease.

**Participants and Methods:** In our preliminary analysis, seven obese adolescents with T2DM and 7 obese non-insulin resistant controls comparable in age, gender, education, ethnicity, BMI, and socioeconomic status completed MRI and neuropsychological evaluations.

**Results:** No gross abnormalities in brain structure were found on MRI, but diffusion tensor imaging (DTI) revealed evidence of subtle white and gray matter pathology among obese adolescents with T2DM. Those subjects also had significantly lower IQ and verbal memory scores and non-significantly lower scores in reading and spelling relative to controls, with an apparent sparing of executive function, verbal fluency, attention, and psychomotor efficiency.

**Conclusions:** This is the first report of significant brain abnormalities among obese adolescents with T2DM, which in the absence of gross vascular disease may reflect the deleterious impact of the metabolic dysregulation of the disease on the CNS. Moreover, given the careful group matching, our findings are unlikely the result of obesity or socioeconomic bias. Future efforts are needed to delineate the underlying pathophysiological mechanisms.

Given that these results are so striking and are of great potential clinical relevance, we are in the process of expanding our subject groups to a more representative size. We anticipate the results to be congruent with our preliminary data.

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## Other

**A. RAMATI, D.M. LITTLE, J.A. SWEENEY, D. PULSIPHER, S. KEEDY, J.W. FINK, E. BODNAR, M. COOPER, K. KELLEY, R. LEE & N.H. PLISKIN. White Matter Integrity and Cognition Following Electrical Injury: A Diffusion Tensor Imaging Study.**

**Objective:** Neuropsychological impairment is a common finding following electrical injury (EI), even in cases in which the point of contact was through an extremity implying peripheral nervous system (PNS) rather than central nervous system (CNS) exposure. Peripheral neurons are particularly susceptible to injury by electrical current. We hypothesized that EI may impact the CNS in a similar fashion, although this has yet to be demonstrated.

**Participants and Methods:** This study examined CNS axonal integrity using diffusion tensor imaging (DTI) and correlated it with neuropsychological functioning in 15 EI patients, all of whom sustained EI via peripheral contact, and 13 demographically matched healthy controls. Patients were seen at least 268 days since their EI.

**Results:** Significantly decreased fractional anisotropy (FA) in EI patients was found in several brain regions including the cingulum fibers, corticospinal tract, forceps major and sagittal stratum. Decreased performances on measures of processing speed and complex attention were significantly correlated with decreased FA in the cingulum, sagittal stratum and corticospinal tract.

**Conclusions:** These novel findings suggest that electrical exposure originating in the PNS disrupts CNS white matter pathways in a persistent manner. These deficits, perhaps reflecting damage to axons or myelin via transmission of electricity to brain via the spinal cord, may represent a mechanism for enduring cognitive dysfunction following EI. Clinically, our findings indicate that DTI studies may provide an objective means for documenting clinically-relevant supraspinal changes in axonal integrity following peripheral EI.

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**O. MATEU-ROBUSTÉ. A Better Look at the Remediation of Learning Disabilities: a Cognitive and Emotional Methodology Applied in a Sample of Cases.**

**Objective:** The hypothesis that the emotional component of behaviors can be explained by a specific neurological mechanism was stated.

**Participants and Methods:** A sample of 749 cases between 5 and 14 year old, with different behavioral and cognitive problems was selected. A sub-sample of 20 cases with PASS planning processing scoring less than 1SD was also selected. A design of mainly qualitative research according to case analysis was followed, behavioral data being provided by patients and their parents and analyzed with video recorder assistance. To avoid the study being biased techniques as triangulation were applied. Quantitative cognitive data were obtained by using the DN:CAS battery for diagnosis of PASS processing. A procedure for diagnosis and treatment of behaviors, previously reported, was followed. The cases of the sub-sample were tested before and after emotional treatment without cognitive remediation, the results being tested by Student's t-test.

The therapeutic procedure is basically based on indirect communication both verbal and non-verbal using techniques such as metaphors, amnesia post-trance and confusion paradox, false alternative option, prescription of the symptoms, and such.

**Results:** The responses were 92% according to the solution of the behavioral problem and the efficient amelioration assessed by the patients, their parents and the researchers. In all cases, observable defensive behaviors diminished sufficiently to deduce an important maturation change. A significant difference was observed in planning. Defensive behaviors such as masquerade behaviors are explained in light of neurological reasons.

**Conclusions:** We concluded that indirect verbal communication techniques help in promoting non-painful feeling processing, which is accomplished by getting extreme attention focalization. We argue that the therapeutic procedure works because it has a positive effect on a psycho-neurological mechanism that produces behaviors predicted by the conceptual framework.

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**S. MAYORAL-RODRÍGUEZ. From Learning to Speak to Reading and Writing Acquisition: Understanding the Development of Cognitive Processing in Children.**

**Objective:** The PASS theory of intelligence understands the cognitive function as an information process or program that can be differentiated in planning, attention, successive and simultaneous. Every process is linked to an anatomical region of the brain: planning to the frontal cortex, attention to the frontal cortex and subcortical structures, successive to the frontal cortex and non-frontal cortex and simultaneous to the non-frontal cortex. Effective remediation is possible when a PASS pattern is known. Our objective was to verify whether dysphasia and dyslexia have a typical PASS pattern.



**Participants and Methods:** The subjects were divided in three groups comprising 12 children with dysphasia, 12 children with dyslexia and 10 children with dysphasia and dyslexia, all of them between 6 years and 12 years of age, the majority boys. All children were administered the DN-CAS test to define the PASS pattern. A control group with 45 normal children was used (Revista Neurología 2000; 30:614-619; 2001:32:30-37).

**Results:** The comparative analysis between groups was planned as follows. The aim was to establish differences in PASS processing between dysphasia and dyslexia, and between these well defined categories and those individuals with a combined dysphasia-dyslexia pattern. The means were compared according to the Student's t-test. Dysphasia shows dysfunction (processing under 1SD) in successive and simultaneous at significant statistical level. Dyslexia shows poor successive process. The successive deficiency is poorer and in different way in dyslexia than in dysphasia which is inferable from comparative analysis between groups.

**Conclusions:** Dysphasia and dyslexia show a typical PASS pattern that allows an appropriate remedial training as a neurocognitive approach. The PASS diagnosis is a psychogenetic diagnosis which is different from the usual diagnosis based on semiology or results obtained with tests that explore non-PASS cognitive functions.

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#### F. PÉREZ-ALVAREZ. Neuroscience and Behavior: A New Insight for Education, Assessment and Remediation.

**Objective:** To communicate an updated view on human behavior on the basis of neuroscience evidence, matching neuroscience to other scientific knowledge.

**Participants and Methods:** Recently reviewed literature will be argued in the light of our own experience, from data collected in 1994-2007, based on both quantitative and qualitative investigation of prefrontal and dysfunctional human behavior in a sample comprising 1333 subjects, aged 5-15. In particular, a fMRI study on decision-making (Human Brain Mapping 2008;29:910-921) made by us in a sample of adolescents will be discussed.

**Results:** Behavior must be neuro-biologically considered any external manifestation of human being whatsoever. In this sense, learning and speaking must be considered behavior. Any behavior in action must be considered the consequence of two mental-neurological activities: one, the cognitive activity and the other, the feeling-sensitivity activity.

We found that a network comprising the posterior and anterior cingulate and the medial anterior prefrontal cortex was significantly and specifically activated by painful moral dilemmas, but not by non-painful dilemmas. These findings provide key evidence that the emotional network is involved in processing painful emotional sensibility; in particular, when decision making takes place. From this and other concordant evidence, we can reasonably deduce that decision making has a cognitive component processed by cognitive brain areas and a sensitivity component processed by emotional brain areas. The structures activated suggest that decision making depends on painful emotional feeling processing rather than cognitive processing when painful feeling processing happens.

**Conclusions:** Taking into account that decision making has to do with personal beliefs (personal identity), which operate more unconsciously than consciously at a neurological level, we can postulate that any behavior whether learning or non-learning happens while it is taking place both cognitive and feeling processing of personal beliefs.

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#### I. STROESCU & B.L. ROPER. Evolutionary Developmental Psychology and its Educational Implications.

**Objective:** Evolutionary developmental psychology (EDP) is explored as the study of human development as a process guided by genetic, ecological, and epigenetic mechanisms which give rise to specific adaptations that are important for natural and sexual selection (i.e., survival and reproduction).

**Participants and Methods:** Research is reviewed that provides evidence that human cognitive and socio-emotional modules have evolved as part of an adaptive "toolkit" for local conditions.

**Results:** In an attempt to offer a more comprehensive account of development, EDP proposes two types of biological cognitive abilities, including primary abilities, which have evolved via natural and sexual selection pressures and are therefore crucial for survival and reproduction, and secondary abilities, which arise from primary abilities only in particular cultural contexts and are important for adaptiveness within a given cultural setting. Academic achievement skills, such as written language skills and formal mathematics, constitute secondary adaptations important in modern cultures, and evolutionary educational psychology examines the relationship between evolved systems of folk knowledge and inferential and attributional biases as these relate to academic learning. Human cognitive and socio-emotional development are directed by the interaction of genetic constraints and developmental experiences in tandem with modularity and neural and cognitive plasticity (Geary, 2005). Within the EDP framework, implications for understanding children's socio-emotional development (e.g., theory of mind and empathy) are also explored.

**Conclusions:** Neuropsychology has traditionally viewed children's cognition from a proximal perspective, without consideration of its origins. EDP offers a broader understanding of development of social competencies and primary and secondary abilities. Research implications are discussed.

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#### C. TIMONEDA-GALLART. Cognition and Emotion during Childhood: Towards a New Neuropsychological Approach to the Assessment and Remediation of Learning Disabilities.

**Objective:** The neurological foundation of both cognitive and emotional phenomenon has not yet conclusively defined. However, nobody denies the interactive functioning of cognition and emotion. Understanding this interaction involves the understanding of behavior on neurological basis. Since 1994, we count on the PASS theory of intelligence, and since 1980s we know more of painful emotional-feeling processing. From a holistic perspective, we have integrated both concepts to explain, at least partially, the reason for intelligent behavior in both normal condition and dysfunctional condition.

**Participants and Methods:** Since 1994, we conduct a line of research based on this framework, using both quantitative and qualitative methods (Revista Neurología 2002;35:612-617).

**Results:** Our results have to do with normal and non-normal subjects. We have defined a characteristic DN-CAS profile related to dysfunctional emotional behavior, which means that a cognitive profile can be used to determine a cognitive dysfunction secondary to emotional dysfunction. We have seen that planning (under 1SD) in emotional behavioral disorders (n=1333), more frequent than expected by chance ( $\chi^2=7.00$ ;  $P=0.008$ ) when compared with a normal control group (n=300). We have identified a typical profile we call it "N" profile because the pattern is similar to the letter N, the frequency of which (n=603) in children with emotional disorders is higher than expected ( $\chi^2=8.00$ ;  $P=0.005$ ) by chance, compared with a normal control group (n=300). This profile is due to the fact that planning and attention are the most sensitive processes to emotional disturbance. A significant success rate in dysfunctional emotional behaviors has been accomplished by using a procedure based on the cognitive-emotional concept mentioned.

**Conclusions:** Input, neurological central processing, and output must be differentiated in any behavior. So, the neurological central processing, not directly observable, is what we must diagnose and treat.

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## Visuospatial Functions/Neglect/Agnosia

**M. VAN ZANDVOORT, H. VAN STRALEN, C. FERRIER, C. DIJKERMAN & F. LEIJTEN.** Direct cortical stimulation of the visual cortex induced retinotopic visual hallucination consistent with hV3/V3A.

**Objective:** The human visual cortex is composed of numerous visual areas whose retinotopic and functional characteristics have been extensively studied. Human lesion studies of functional damage and functional imaging have provided convergent evidence, yet support from direct cortical stimulation in humans is lacking.

**Participants and Methods:** a right handed woman of 37 yr (VR) suffered from intractable localised epilepsy due to cortical dysplasia of the right temporo-occipital cortex. EEG registration demonstrated a right posterior temporal focus and she was admitted for resection. She had no visual field damage nor impairments in visuoperception or construction and no symptoms of neglect before operation. Prior to resection electrocortical stimulation was performed to delineate cortical areas with respect to function. Bipolar stimulation was applied to several different positions in the visual cortical areas.

**Results:** VR experienced vivid simple visual hallucinations in the contralateral hemifield of a monochromatic 3D 'bubble' which moved diagonal from the upper left to the lower right corner of the left visual field. Hallucinatory experiences were resistant to voluntary saccadic eye-movement and were also present with eyes shut. Location of the involved pair of microelectrodes were suggestive for hV3/V3A.

**Conclusions:** This study of direct cortical stimulation provides unique convergent evidence on the role of tertiary cortical visual area in perception of movement and contrast.

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## Symposium 8: Multisite Transdisciplinary Studies of Child Health and Illness

**Chair: Robert Annett**

**Discussant: Gerard Gioia**

**10:00–11:30 a.m.**

**R.D. ANNETT, K.R. KRULL, G.A. GIOIA, R.D. ANNETT, S.R. HOOPER, D. WHITE, L. KRIVITZKY, P. BROUWERS & K.R. KRULL.** Multisite Transdisciplinary Studies of Child Health and Illness.

**Symposium Description:** Pediatric clinical trials and epidemiological studies provide a unique opportunity for neuropsychology to contribute to our understanding of the inter-relationship of disease and health to child health status outcomes. Six presentations in this symposium provide participants with an overview of national and international clinical trials and epidemiological studies of child health and development. Complex sampling and methodological issues will be a focus to these presentations, including sampling frames for developmental outcomes, experimental vs. clinical trials, cross-cultural measurement challenges, endpoint determination, and political barriers to completing the research. Methodological issues unique to each of the 6 studies will be described and opportunities for collaboration with neuropsychology presented. A secondary aim of the symposium is to provide information on the studies so that neuropsychologists can form linkages with the study investigators to further the research opportunities afforded.

Specific clinical trials and epidemiological studies presented will include: the National Children's Study (NCS), Chronic Kidney Disease in Children (CKiD) Study, Silent Infarct Transfusion Trial for Sickle Cell Disease, Urea Cycle Disorders Consortium, Pediatric HIV/AIDS Studies, and the Childhood Cancer Survivor Study (CCSS).

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**R.D. ANNETT & P. SCHEIDT.** The National Children's Study.

**Objective:** The National Children's Study will examine the effects of environmental influences on the health and development of more than 100,000 children across the United States, following them from before birth until age 21. The goal of the study is to improve the health and well being of children. The study defines "environment" broadly and will take a number of issues into account, including: natural and man-made environment factors; biological and chemical factors; physical surroundings; social factors; behavioral influences and outcomes; genetics; cultural and family influences and differences; and geographic locations. The research will examine how these elements interact and the effects they might have on children's health, specifically including child neurocognitive functioning. Study procedures are being developed to understand the determinants of neurobehavioral disorders, including ADHD and Autism. The development and unfolding of the measurement procedures and outcomes provides pediatric neuropsychologists with unprecedented opportunities for collaborative research. The focus of this presentation will be on familiarizing the audience with current information about the NCS procedures that are unfolding as well as procedures for ancillary study proposals.

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**S.R. HOOPER, R. BUTLER, A. GERSON, S. FURTH & B. WARADY.** Chronic Kidney Disease in Children (CKiD): Challenges and Opportunities.

**Objective:** The CKiD Program is a multisite, transdisciplinary research study funded by National Institute of Diabetes and Digestive and Kidney Diseases to examine key issues pertinent to children with mild renal insufficiency: neurocognitive, cardiovascular, growth, and kidney disease progression. The study has over 50 active sites across the US and Canada, and represents one of the largest initiatives studying mild kidney disease in the world. For the neurocognitive portion of the study, school-age participants receive a neurocognitive battery consisting of IQ (WASI), achievement (WIAT-II-A), attention regulation (CPT-II), and ratings of executive functions (BRIEF). A variant of this battery is given for younger participants. At present, 462 participants, ages 1 to 16 years of age, have been recruited at baseline, with 153 participants already having a second visit. Findings to date reflect low average IQ and achievement skills and mild deficits in attention and impulsivity, with a high proportion of participants falling at least one standard deviation below the test means. Specific challenges in this study have included identifying psychologists at each site, quality assurance, data completeness, maintaining ongoing interest and involvement, technical assistance, and understanding the transdisciplinary interactions at each site. Despite these challenges, opportunities have included involvement in a major research project for those who are interested in research, but who are over-committed with clinical duties, cost sharing with respect to patient care, expansion the network of psychological providers in pediatric nephrology, and increased use of a transdisciplinary approach to patient care and research for children with mild kidney disease.

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**D. WHITE, R. MCKINSTRY, M. NOETZEL, B. BARTON, J. CASELLA & M. DEBAUN. Silent Infarct Transfusion Trial for Sickle Cell Disease.**

**Objective:** Sickle cell disease (SCD) affects 1 in 400 African Americans. It is estimated that 22% of children with SCD experience silent cerebral infarcts (often referred to as silent strokes). These infarcts are not detectable on neurological examination but are visible with neuroimaging and are associated with increased risk of cognitive impairment and further neurological compromise (e.g., overt stroke). The Silent Infarct Transfusion Trial (SITT) is an international, multicenter study supported by the National Institute of Neurological Disorders and Stroke. Two dozen institutions participate across the United States, Canada, France, and England. The primary aim is to evaluate the effectiveness of blood transfusion in preventing new infarcts (overt or silent) in children with existing silent infarcts related to SCD. The secondary aims are to evaluate the effectiveness of blood transfusion in preventing declines in IQ and to determine if benefits of blood transfusion outweigh risks. In terms of enrollment, the goal is to screen 1,500 children with MRI to identify 204 children with silent infarcts. Children with silent infarcts are then randomized to transfusion or observation arms of the study. Upon randomization, children receive MRI and cognitive evaluations, which are repeated after 36 months. In terms of challenges, standardization of the trial required 11 months and the planned enrollment period increased from 24 to 54 months. In terms of benefits, results of the trial could lead to changes in standard care for children with SCD and silent infarcts. Additional benefits and challenges of the trial will be discussed.

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**L. KRIVITZKY & M. CULLEN GIBBS. Urea Cycle Disorders Consortium.**

**Objective:** The Office of Rare Diseases (ORD) of NIH established a Rare Diseases Clinical Research Network (RDCRN) together with the National Center for Research Resources (NCRR)/General Clinical Research Consortium (GCRC) Program. As part of the RDCRN, the Urea Cycle Disorders Consortium (UCDC) was created. The original UCDC consisted of a consortium of eight academic institutions in the US, although this has since expanded to include several more US sites, with additional sites in Canada and Switzerland. Urea cycle disorders (UCD) are a group of rare inborn errors of metabolism that commonly present in childhood with episodes of vomiting lethargy and coma. Symptoms are the result of an accumulation of ammonia, a toxic product of protein degradation, which is not adequately metabolized in the liver of affected individuals due to an enzyme deficiency present from birth. The risk of death or severe disability from these disorders approaches 50%, and current therapy is considered inadequate. The purpose of the study is to perform a long-term follow-up of a large group of patients with urea cycle disorders. Assessment of survival and neurocognitive outcome of the two most commonly used forms of treatment, alternate pathway therapy and liver transplantation are occurring. The study seeks to identify biomarkers for predicting future metabolic imbalances so that they can be corrected before clinical symptoms develop. The objective of this presentation is to provide audience members with information on the challenges faced in developing outcome measures of neurocognitive function that are relevant across sites.

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**P. BROUWERS. Pediatric HIV/AIDS Studies.**

**Objective:** Since HIV is a neurovirulent virus, neurobehavioral manifestation particularly in perinatally infected infants and children, have been a hallmark of this infection. Thus treatment studies have often included neurobehavioral variables as secondary and even as primary outcome measures. The epidemiology of the infection in children has re-

quired the creation of domestic and international networks for the conduct of such clinical trials which are often conducted in low-resource environments. These networks include among others the Pediatric AIDS Clinical Trials Group (PACTG), the International Maternal Pediatric Adolescent AIDS Clinical Trials Network (IMPAACT), and the Pediatric HIV/AIDS Cohort Study (PHACS). The methodological and scientific complications of conducting neurobehavioral studies under such circumstances as well as possible solutions will be discussed. Specific emphases in this presentation will be given to issues of valid and reliable longitudinal assessment, cross-cultural issues in tests, test taking, and test administration, integrating and competing with other disciplines involved in the trial, continuous versus 'event-based' analysis, and ethical issues post-completion of the trial.

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**K.R. KRULL, G.T. ARMSTRONG & L.L. ROBISON. Childhood Cancer Survivor Study.**

**Objective:** The Childhood Cancer Survivor Study (CCSS) was established in 1994 as a resource to study late effects of pediatric cancer. Its primary goals are to 1) gain new knowledge about the long-term effects of cancer and therapy, and 2) to educate survivors about these potential impacts. CCSS is a collaborative, multi-institutional transdisciplinary study, currently in its 16th year of continuous funding by the National Cancer Institute. It is composed of individuals who survived five or more years after treatment for leukemia, central nervous system malignancy, Hodgkin disease, non-Hodgkin lymphoma, neuroblastoma, soft tissue sarcoma, kidney cancer, or bone cancer, all diagnosed during childhood or adolescence. A retrospectively established cohort of over 20,000 childhood cancer survivors, diagnosed between 1970 and 1986, and 4,000 siblings of survivors serve as participants. An expansion was recently begun to recruit new survivors and siblings. The original cohort was assembled through 27 participating centers in the United States and Canada, and has been followed prospectively to this date. Detailed participant data is available on demographics, cancer and medical care, prescription medication, and for conditions related to sensory, hormonal, cardiovascular, respiratory, digestive, and brain/nervous systems. Interval collection of neurocognitive and psychosocial functioning, and tissue samples for genetic analysis is also conducted. The objective of this presentation will be 1) to provide an overview of CCSS, 2) to discuss the procedure for submitting data analysis concepts utilizing existing data, and 3) to review the process for ancillary studies to recruit the cohort for new data collection.

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**Paper Session 8:  
Traumatic Brain Injury (Child)**

**10:45 a.m.–12:15 p.m.**

**J.B. FULTON, K.O. YEATES, S.L. WADE, H.G. TAYLOR & N.C. WALZ. Cognitive predictors of academic achievement in preschool children 1 year following traumatic brain injury.**

**Objective:** Data from a prospective, longitudinal study were used to examine cognitive predictors of academic achievement in preschool children with traumatic brain injury (TBI) and orthopedic injury (OI) shortly after injury and 1 year post-injury.

**Participants and Methods:** Participants included 3 to 6 year old children, 76 with mild to severe TBI and a comparison group of 86 children with OI. Academic achievement was assessed approximately 1 month and 12 months post injury, using three subtests from the Wood-

cock-Johnson Tests of Achievement-Third Edition and the School Readiness Composite from the Bracken Basic Concepts Scale-Revised. Intelligence, memory, and executive functions were measured at the initial assessment using standardized cognitive tests (i.e., DAS, WJ-III Story Recall, Shape School, Delayed Alternation).

**Results:** Hierarchical linear regression was used to predict academic achievement at the initial and 1 year follow up assessments. Group membership and demographic variables were entered as predictors in the first step, measures of executive function and memory were entered in the second step, and a measure of general intellectual functioning was entered in a third step. Memory and executive functions were significant predictors of academic achievement at both assessments, after controlling for group membership and demographic variables. Executive function remained a significant predictor for some outcomes after taking general intellectual functioning into account. The relationships of cognitive predictors to academic achievement did not vary across the TBI and OI groups.

**Conclusions:** Both memory and executive function predict academic achievement following TBI in preschool children, although general intellectual functioning is a stronger predictor.

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#### M. PRASAD, M. BARNES & L. EWING-COBBS. Executive Skills Following Moderate to Severe TBI in Preschoolers and School-Aged Children.

**Objective:** Preschoolers and school-aged children with moderate to severe traumatic brain injury (TBI) have been found to have deficits in some domains of executive functioning. This study examined ratings of executive skills one year post injury in preschoolers and school-aged children with TBI.

**Participants and Methods:** Participants were 50 school-aged children (mean age=11 years) and 20 preschoolers with moderate to severe TBI (mean age=46 months) as well as 54 age matched comparison children. Caregivers completed the Behavior Rating Inventory of Executive Function (school-age and preschool versions) one-year post injury. The two measures have five subscales in common: Inhibit, Shift, Emotional Control, Working Memory, Plan/Organize. Both measures provide a Global Executive Composite (GEC) score as well as a Metacognitive Index score, referred to as Emergent MI on the preschool version.

**Results:** Neither significant group by age interactions nor main effects for age were found. Children with TBI were rated significantly higher on the GEC ( $p=.001$ ) and on the Metacognitive Index ( $p=.006$ ) than the comparison group. On the subscales, the TBI group was rated as having significantly worse Emotional Control ( $p=.003$ ) and Working Memory ( $p=.0003$ ). The TBI group also differed from controls on Plan/Organize ( $p=.01$ ) and Inhibit ( $p=.01$ ). The groups did not significantly differ on Shift ( $p=.09$ ).

**Conclusions:** Regardless of age, children with TBI were rated as having significantly worse executive skills one year post injury than comparison children. Executive dysfunction, characterized by difficulties with both emotional and behavioral regulation, is pervasive following TBI sustained across childhood. R01 NS 46308, R01 NS 24962.

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#### K. YEATES, H. TAYLOR, J. RUSIN, B. BANGERT, A. DIETRICH, K. NUSS, M. WRIGHT, D.S. NAGIN & B.L. JONES. Longitudinal Trajectories of Post-Concussive Symptoms in Children with Mild Traumatic Brain Injuries and Their Relationship to Acute Clinical Status.

**Objective:** This study examined whether mild traumatic brain injuries (TBI) in children and adolescents, especially when associated with clinical features reflecting more severe injury, result in different post-injury trajectories of post-concussive symptoms (PCS) than mild orthopedic injuries (OI).

**Participants and Methods:** Participants in this prospective and longitudinal cohort study were 8 to 15 year old children, 186 with mild TBI and 99 with mild OI, recruited from consecutive admissions to Emergency Departments in two large children's hospitals. Parents rated current PCS within 3 weeks of injury and at 1, 3, and 12 months post injury. At the initial assessment, parents also provided retrospective ratings of pre-injury symptoms, and children with mild TBI completed magnetic resonance imaging (MRI) of the brain. Clinical features examined as predictors of PCS included loss of consciousness, Glasgow Coma Scale score below 15, other injuries, acute symptoms of concussion, and intracranial abnormalities on MRI.

**Results:** Finite mixture modeling identified four longitudinal trajectories of PCS (i.e., No PCS, Moderate Persistent PCS, High Acute/Resolved PCS, High Acute/Persistent PCS). Children with mild TBI were more likely than those with OI to demonstrate High Acute/Resolved and High Acute/Persistent trajectories relative to the No PCS group. The two trajectories with high acute levels of PCS were especially likely among children with mild TBI whose acute clinical presentation reflected more severe injury.

**Conclusions:** Mild TBI during childhood and adolescence, particularly those that are more severe, are more likely than OI to result in transient or persistent increases in PCS in the first year post-injury.

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#### K. YEATES, S.L. WADE, N.C. WALZ & H. TAYLOR. The Home Environment as a Moderator of Psychosocial Outcomes following Traumatic Brain Injury in Young Children.

**Objective:** The study sought to determine whether parenting style, family functioning, and the quality of the home are significant moderators of social, behavioral, and adaptive functioning after traumatic brain injury (TBI) in young children.

**Participants and Methods:** Participants were recruited prospectively from consecutive admissions of 3-6 year old children, and included 22 with severe TBI, 64 with complicated mild/moderate TBI, and 109 with orthopedic injuries (OI). Four assessments were completed across the first 18 months post-injury. The initial assessment included measures of parenting style (Parenting Practices Questionnaire), family functioning (Family Assessment Device), and the quality of the home (HOME). Psychosocial outcomes were assessed using the Child Behavior Checklist (CBCL), Adaptive Behavior Assessment System (ABAS), and Preschool and Kindergarten Behavior Scales (PKBS). Mixed model analyses examined the relationship of the home environment to psychosocial outcomes across time.

**Results:** The OI and severe TBI groups differed significantly in social skills (PKBS), but the group difference was not moderated by the home environment. In contrast, the home environment was a significant moderator of behavioral adjustment (CBCL) and adaptive functioning (ABAS). Differences in behavioral adjustment between the TBI and OI groups became more pronounced across time at high levels of authoritarian and permissive parenting. Differences in adaptive functioning between the TBI and OI groups became more pronounced across time for children from less stimulating homes.

**Conclusions:** The home environment appears to moderate the psychosocial outcomes of TBI in preschool children. Authoritarian and permissive parenting styles, as well as less stimulating homes, exacerbate negative outcomes.

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#### M.B. ONI, E.A. WILDE, R. YALLAMPALLI, T.C. WU, Z. CHU, X. LI, J.V. HUNTER, E.D. BIGLER, A.C. VASQUEZ & H.S. LEVIN. Diffusion Tensor Imaging Analysis of the Frontal Lobes in Pediatric Traumatic Brain Injury.

**Objective:** Diffusion Tensor Imaging (DTI) is an MRI sequence that is sensitive to demyelination, axonal damage, and other pathologic changes, using indices such as fractional anisotropy (FA), apparent diffusion coefficient (ADC) and radial diffusivity (RD). This study examined changes in frontal white matter.

**Participants and Methods:** Forty-seven children aged 8-16 years with moderate-to-severe TBI and forty-six children with orthopedic injuries of comparable demographic indices underwent volumetric imaging at 3 months post-injury, using Philips 1.5T MRI scanners and 15-direction DTI protocol. Quantitative tractography of the frontal lobes was performed using Philips PRIDE v4.1 software.

**Results:** T-tests revealed significant group differences in right frontal FA ( $t(5.65)$ ,  $p<0.001$ ), ADC ( $t(-2.81)$ ,  $p=0.007$ ) and RD ( $t(-3.58)$ ,  $p<0.001$ ), and left frontal FA ( $t(6.18)$ ,  $p<0.001$ ), ADC ( $t(-3.37)$ ,  $p=0.001$ ) and RD ( $t(-4.46)$ ,  $p<0.001$ ), where TBI patients demonstrated lower anisotropy and higher diffusivity than the OI group. Additionally, significant correlations existed between Glasgow Outcome Scale score and right frontal FA ( $r=-0.33$ ,  $p=0.014$ ), ADC ( $r=0.39$ ,  $p=0.014$ ), and RD ( $r=0.40$ ,  $p=0.011$ ), and left frontal FA ( $r=-0.42$ ,  $p=0.008$ ) in TBI group, where greater axonal integrity was associated with better recovery. Finally, these DTI indices were significantly related to the Glasgow Coma Scale score ( $p$  values ranging from 0.01-0.002), with lower anisotropy and higher diffusivity relating to greater injury severity.

**Conclusions:** The frontal lobes are known to be highly vulnerable regions in TBI, as demonstrated in this study. These results can be used in future endeavors to assess neuronal plasticity, detect pathologic changes overlooked by conventional imaging, and monitor the effectiveness of therapeutic interventions after traumatic brain injury.

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### Invited Symposium: Principles of Experience-Dependent Rehabilitation: From Animals to Aphasia Treatment

Chair: Anastasia Raymer

Discussant: Leslie Gonzalez-Rothi

10:45 a.m.–12:15 p.m.

A.M. RAYMER, L.J. GONZALEZ ROTH, L. TURKSTRA, L. MURRAY & L. EDMONDS. **Principles of Experience-Dependent Rehabilitation: From Animals to Aphasia Treatment.**

**Symposium Description:** Neurorehabilitation research, including aphasia treatment research, has been influenced by several bodies of basic research in the neurosciences and cognitive sciences. One line of research uses animal models to study rehabilitation following brain injury (for a recent review, see Kleim & Jones, 2008). What is too often missing, however, is the bridge between basic and clinical research perspectives. The National Institutes of Health, as part of its Roadmap initiative, has instituted efforts to support translational research that encourages greater interaction between basic and clinical rehabilitation scientists. A forum of neuroscience and clinical speech pathology researchers convened recently to share perspectives and strategize on future rehabilitation research endeavors. As an extension of that meeting, the purpose of this symposium is to review briefly several principles of neuroscience that have direct or indirect relevance to rehabilitation of cognitive domains in humans. We will delineate a framework that we proposed to guide future neurorehabilitation research endeavors (Raymer et al., 2008). We will then describe in three examples how aphasia treatment research has been influenced by these neuroscience principles. Finally, Dr. Rothi will serve as a discussant and provide her perspectives on the ways to most effectively promote translational research initiatives in the rehabilitation of aphasia and various other cognitive disorders.

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A.M. RAYMER, J. PATTERSON, L. CHERNEY, T. FRYMARK, T. SCHOOLING & R. MULLEN. **Intensity of Treatment in Aphasia: A Systematic Review**

**Objective:** Evidence from animal studies suggests that neurorehabilitation is enhanced when treatment is delivered intensively. Aphasia treatment studies also have examined intensity effects for patients recovering from stroke-induced aphasia. Further, the principle of 'use it to improve it' emanating from animal studies has influenced recent studies using constraint-induced language therapy (CILT), a treatment method implementing intensive forced language use. The purpose of this systematic review, undertaken with the support of the American Speech-Language-Hearing Association (ASHA), was to examine these issues in the aphasia treatment literature.

**Participants and Methods:** We searched 15 electronic databases and identified 10 studies providing direct evidence to answer our clinical questions, six of which addressed intensity and five that addressed CILT. Panel members reviewed studies for methodologic quality using a system developed within ASHA and calculated effect sizes if possible.

**Results:** Clinical trials ranging from medium to high methodologic quality suggested that more intensive treatment led to better outcomes for standardized aphasia tests, yet less intensive treatment led to better outcomes for some measures of communication in daily life activities. Several clinical trials of medium to high methodologic quality examining outcomes for standardized aphasia tests and measures of communication activities/participation favored CILT over comparison treatments.

**Conclusions:** These findings suggest that the positive effects of CILT are influenced in some part by the intensity of the treatment protocol. Yet forced language use also plays an important role. Clinical trials are currently under way contrasting the effects of intensity and forced language use in aphasia treatment outcomes.

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L. MURRAY. **Complexity: Friend or Foe When Remediating Syntactic Processing Deficits in Aphasia?**

**Objective:** Animal research suggests that greater functional outcomes and positive neuroplastic changes can be achieved if training targets complex/skilled behaviors or exploits complex/enriched environments. Accordingly, aphasiologists have begun exploring whether manipulating such training principles influences outcomes following treatment for impaired syntactic processing. The purpose of this presentation is to critically review the relevant aphasia treatment research in terms of (a) generalization effects associated with training complex syntactic structures within complex contexts and (b) how patient characteristics may moderate complexity manipulation effects.

**Participants and Methods:** Previous aphasia treatment studies that targeted syntactic impairments and manipulated the complexity of treatment stimuli or contexts are reviewed. A recent study (Murray & Karcher, 2008), in which three adults with varying aphasia profiles received an adapted, written version of Treatment of Underlying Forms, will be examined in greater detail to exemplify theoretical and methodological issues associated with this line of aphasia research.

**Results:** A growing literature indicates that training complex syntactic structures can result in generalization to untrained, less complex but related structures, and that training written sentence production facilitates cross-modal generalization to spoken production. Preliminary data also suggest that patient variables such as presence of concomitant cognitive deficits may moderate generalization effects.

**Conclusions:** These findings underscore complexity as a potent training variable that can be manipulated to enhance generalization. Future aphasia research must delineate how complexity interacts with other neuroscience principles (e.g., is complexity more germane in acute vs. chronic treatments?) and identify further patient characteristics that might mediate the effects of these influential principles.

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**L. EDMONDS. Examining Generalization and Saliency in Verb Network Strengthening Treatment (VNeST), A Semantic Treatment for Lexical Retrieval Impairments in Aphasia.**

**Objective:** Generalization, or improvement on untrained tasks, has been documented in animals who have undergone rehabilitation for physical impairments or losses (e.g., Kolb, 1995). In aphasia rehabilitation, generalization is a primary outcome goal. An important dependent variable is saliency, or perceived value or relevance, treatment has for the participant. This presentation examines generalization and saliency in Verb Network Strengthening Treatment (VNeST), a semantic treatment that systematically targets lexical retrieval around verb networks with the aim of improving lexical retrieval in related yet untrained stimuli and contexts in persons with aphasia.

**Participants and Methods:** In two single-subject multiple baseline across subjects studies (Edmonds, Nadeau, & Kiran, in press; Edmonds & Babb, in preparation), four participants with moderate and two with moderate-severe aphasia (> 9 MPO of stroke) participated. Treatment primarily included generating agent-patient pairs (chef/sugar, carpenter/lumber) for trained verbs (measure) (N=10), including personally relevant pairs.

**Results:** Weekly probes included picture description for scenarios containing trained (The carpenter measures the stairs.) and untrained (The nurse weighs the baby.) verbs. All participants exhibited generalization on both sets of sentences with no improvement on an adjective control task. Post-treatment measures showed improvements on standardized tests of lexical retrieval of single nouns, verbs and sentences for all participants with improvements in connected speech for 3 of 4 participants with moderate aphasia.

**Conclusions:** VNeST encourages participants to activate and retrieve semantic networks of words around a verb that can represent multiple relevant schemas. It is proposed that improved lexical retrieval across untrained stimuli and tasks is possible due to the expansive and relevant semantic networks activated.

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**L. TURKSTRA. Animal Research and Neurorehabilitation: Principles and Practices.**

**Objective:** In recent years there has been an exponential increase in our knowledge about the neural mechanisms underlying recovery and rehabilitation after stroke. This knowledge has derived primarily from animal research. While there are obvious limitations in applying the results of animal studies to human clinical contexts, these studies have revealed principles that are critical to our understanding of human recovery and rehabilitation. The aim of this presentation is to summarize several of these principles and discuss potential limitations in their application to humans, with a focus on recovery from acquired cognitive impairments. The studies focus on the subacute and chronic phase post-injury, when most rehabilitation occurs.

**Participants and Methods:** This presentation is a synthesis of findings from current and historical peer-reviewed publications.

**Results:** In large part, the results of animal research support historical views on aphasia therapy, such as that treatment is most effective when delivered with high intensity in the sub-acute or chronic stage post-injury, behaviors with personal relevance to the organism are most likely to be learned and maintained, and continued rehearsal is required for maintenance of treatment gains. The data also indicate that age at injury is a critical factor in both recovery from stroke and response to rehabilitation.

**Conclusions:** Animal studies have provided empirical support for many traditional practices in aphasia therapy, and directions for future rehabilitation studies in aphasia and other cognitive disorders. The findings also suggest a model of aphasia therapy that challenges current trends in reimbursement for rehabilitation.

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**Poster Session 7:  
Child Assessment, ADHD, LD, Autism**

**10:45 a.m.–12:15 p.m.**

**ADHD/Attentional Functions**

**M.T. ACOSTA, J. BULBIN & K. WALSH. Parent Reported Executive Function in Children with Neurofibromatosis type 1 with and without Comorbid Attention Deficits.**

**Objective:** To determine if there are differential executive function profiles in children with Neurofibromatosis type 1 (NF1-AD) and children with NF1 and comorbid attention deficits (NF1+AD).

**Participants and Methods:** This is a retrospective study of 36 children with diagnosis of NF1 characterized as having general regulatory control difficulties. Clinical neuropsychological evaluations were obtained from chart review and 25 patients had complete data. Patients were categorized into two groups - significant attention deficits (NF1+AD) or no attention deficits (NF1-AD) using a cutoff score of seven on the TEA-Ch Sky Search DT. Fifteen of the 25 patients were categorized as NF1+AD (60%) based on these criteria.

**Results:** Significant ( $p < 0.5$ ) differences were identified between the two groups on the BRIEF for the Behavioral Regulation Index (NF1+AD  $M=66.5$ ,  $SD=8.78$ ; NF1-AD  $M=54.0$   $SD=8.01$ ) and the Global Executive Composite (NF1+AD  $M=71.0$ ,  $SD=8.85$ ; NF1-AD  $M=53.9$ ,  $SD=18.79$ ). There was a trend toward higher levels of anxiety in the NF1+AD group by parent report (NF1+AD  $M=59.0$ ,  $SD=15.35$ ; NF1-AD  $M=48.8$ ,  $SD=9.39$ )

**Conclusions:** These data reveal significant differences in reported executive functioning between children with NF1 with and without significant comorbid attention deficits with regard to global executive functions and particularly within the behavioral regulation domain, which includes skills such inhibitory control, cognitive flexibility and emotional control. Higher levels of anxiety appear to be more prevalent in the children with comorbid attention deficits as well

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**H. BARNARD, B.F. PENNINGTON & E.G. WILLCUTT. Gene x Environment Interactions in Attention Deficit Hyperactivity Disorder.**

**Objective:** The objective of this study was to test a diathesis-stress model of gene x environment (g x e) interactions in Attention Deficit Hyperactivity Disorder (ADHD). To date, few studies have investigated multiple genetic and environmental risk factors, explored the dimensional specificity of interactions, or attempted to minimize comparisons.

**Participants and Methods:** Participants included 1,473 children and 480 parents selected from a community-based sample. Within-family (FBAT/PBAT) and case-control methodology were used to explore: (1) main effects of polymorphisms in the DRD2, DRD4, DRD5, DAT1, 5HTT, ADRA2C and DBH genes on ADHD symptoms, (2) main effects of environmental risk factors on ADHD symptoms, (3) g x e interaction effects between those environmental and genetic risk factors substantiated by main effects, and (4) dimensional specificity of interactions.

**Results:** Analyses demonstrated a robust main effect of the DRD4 4-repeat allele (DRD4\*4R) on ADHD symptoms rather than the DRD4 7-repeat allele (DRD4\*7R), previously implicated in ADHD. Taken in the context of gene-environment correlations, analyses revealed significant main effects of season of birth and parental education on ADHD symptoms. Results also demonstrated significant diathesis-stress g x e interactions between DRD4\*4R and season of birth, maternal smoking, and parental education that selectively exacerbated hyperactive-impulsive (HI) symptoms.

**Conclusions:** Taken together, these data are consistent with a diathesis-stress model for  $g \times e$  interactions in ADHD, suggest a possible alternate risk factor in linkage disequilibrium with DRD4\*4R and DRD4\*7R that may be the true “risk” allele, and support the idea that polymorphisms in DRD4 interact with environmental risk factors to selectively exacerbate HI symptoms.

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**D.W. BEEBE, E. LONG, M. KRAMER, M. RIS & R. AMIN. Attention and Sleep Disruption in Overweight 10-16 Year-old Children and Adolescents.**

**Objective:** Primary school children who have disrupted sleep have been reported to display attention problems. However, few investigations have examined this relationship in older children, and most studies associated subjective sleep measures with subjective attention measures, which can spuriously inflate correlations. We previously reported preliminary findings from what was then an ongoing study of overweight 10-16 year-olds, a group selected because of their high risk of sleep pathology. Here we report on the associations between objective measures of sleep disruption and attention functioning in the final sample.

**Participants and Methods:** 175 participants ( $M=13.5$  years,  $sd=1.9$ ) underwent overnight polysomnography and week-long actigraphy, were administered a neuropsychological battery that included the Gordon Diagnostic System and TEA-Ch Map Mission, and were rated by parents and teachers on the BASC and BRIEF.

**Results:** Polysomnography-based indexes of sleep disruption or blood oxygen saturation did not reliably correlate with attention in the full sample, nor in the 135 subjects who wore their actigraphs at least 5 nights (a reliability threshold). However, in that subsample, actigraphy-based sleep disruption correlated with age-normed scores on the Gordon, TEA-Ch, and teacher-reported attention and working memory, Spearman  $r= .25-.27$ ,  $p < .02$ , but not with parent-reported attention or working memory,  $r < .07$ .

**Conclusions:** The small but reliable correlations between sleep disruption and daytime attention problems raise questions about the relationship between the neurological systems that underlie attention and arousal. These findings also highlight the importance of examining sleep across multiple nights in the home setting, rather than relying solely upon single-night inpatient polysomnography.

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**B. BUTCHER & N. NUSSBAUM. Neuropsychological Constructs of Attention in Children with Nonverbal Learning Disability and Attention Deficit/Hyperactivity Disorder.**

**Objective:** Nonverbal Learning Disability (NLD) is characterized by impaired social perception, visual-spatial skills, fine motor coordination, and mathematics abilities. Research suggests that the majority of children with NLD meet clinical criteria for Attention Deficit/Hyperactivity Disorder. While children with NLD exhibit many of the behavioral manifestations of ADHD, the underlying deficits may be different depending on the attention construct and modality (i.e. auditory vs. visual). This study examined neuropsychological constructs of attention including working memory, processing speed, vigilance, and inhibition, to clarify the relation between attention problems in children with NLD and ADHD.

**Participants and Methods:** This study included 88 children between the ages of 9 and 15 years old, who were referred to a neuropsychology clinic in the southwest and met criteria for one of the three diagnostic groups including NLD, ADHD:PI, and ADHD:C. The groups were expected to differ depending on the attention construct and the modality of the attention measure.

**Results:** A multivariate analysis of variance (MANOVA) was conducted to test for group differences among the attention domains with diag-

nostic group as the independent variable and WISC-IV Digit Span Backward, WISC-IV Letter/Number Sequencing, Trails B, WISC-IV Coding, CPT-Variability, and CPT-Commissions as the dependant variables. Results indicated a statistically significant difference among groups, Wilks'  $\lambda = .631$ ,  $F(12, 160) = 3.456$ ,  $p < .001$ . Follow-up test results indicated that groups significantly differed only on visual measures of attention. Furthermore, directional differences depended on the attention construct.

**Conclusions:** Children with ADHD differed significantly from children with NLD depending on the attention modality and construct. Knowledge regarding the specific attention deficits of children with NLD can contribute to the formulation of valid diagnostic criteria and assist in the implementation of effective intervention strategies.

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**S.M. CLERKIN, A. BÉDARD, J. DAVIDOW, K. BROCKI, J. FAN, J. NEWCORN & J. FOSSELLA. Testing the Efficiency and Independence of the Alerting, Orienting, and Executive Attention Networks in Children with ADHD.**

**Objective:** Various models of attention-deficit/hyperactivity disorder (ADHD) have posited deficits in the alerting, orienting, and/or executive attention networks. The child version of the Attention Network Task (Child ANT) has successfully been used to measure the efficiency and independence of these attention systems in typically developing children. Utilizing the Child ANT, we tested whether these networks show similar efficiency and independence in a sample of children with ADHD.

**Participants and Methods:** We compared Child ANT performance of school-aged children with ADHD ( $N = 50$ ) and an age-and-gender matched community-based sample ( $N = 70$ ). Reaction time and accuracy for components of the alerting (double cues vs. no cues), orienting (central cues vs. spatial cues), and executive (incongruent vs. congruent flankers) attention networks were entered into mixed ANOVAs, and correlations between network index scores were calculated.

**Results:** Poorer performance by the ADHD group was evident in all three attention networks, and was most evident for targets with incongruent flankers, targets preceded by no cues and targets preceded by spatial cues. Although there were no significant correlations among the three attention networks in the control sample, the alerting and orienting index scores were positively correlated in the ADHD children.

**Conclusions:** The poorer performance of the ADHD group may reflect underlying deficits in tonic arousal levels and sustained attention, and in the ability to shift attention and deal with conflict. While these attention networks function independently in healthy children, children with ADHD demonstrate overlapping functioning of the alerting and orienting networks, which might contribute to less efficient cue-related processing.

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**F.J. GALLO, M.J. CHAFFIN, A. HEFFELFINGER & J.L. CULBERTSON. Relations between CPTs and Parent Ratings of Inattention and Hyperactivity: The Moderating Effects of IQ.**

**Objective:** Continuous performance tasks (CPTs) are neuropsychological measures commonly used to assess attention and response control in children and adolescents. Studies examining their relation to inattentive and hyperactive/impulsive behaviors in real-world settings have yielded mixed results. These inconsistent findings may, in part, be attributed to the varying levels of overall intellectual functioning that comprise experimental samples. The current study explores the potential moderating effects of IQ on this relationship.

**Participants and Methods:** Participants were 92 clinic-referred children and adolescents, ages 6-16 ( $x = 10.39$ ,  $sd = 2.5$ ). Each child was

administered the IVA-CPT (auditory and visual) and the WISC-IV. Participants with FSIQs between 70 and 115 were included in the current study ( $x = 92.65$ ,  $sd = 11.53$ ). Parent ratings of inattentive and hyperactive behavior from either the BASC or BASC-2 were also examined. For all analyses, standard and T-scores that are adjusted for age were used.

**Results:** Children were separated into 3 groups according to FSIQ: Group 1, FSIQ 70–85 ( $n = 30$ ); Group 2, FSIQ 86–100 ( $n = 33$ ); Group 3, FSIQ 101–115 ( $n = 29$ ). In Group 1, significant relations between the IVA full-scale Attention Quotient (AQ) and both BASC Attention Problems ( $r = -.417$ ,  $p < .05$ ) and Hyperactivity ( $r = -.477$ ,  $p < .01$ ) scales were found. This relationship failed to reach significance in Groups 2 and 3. In regards to BASC Attention Problems, a significant IQ  $\times$  AQ interaction was confirmed ( $F [1, 88] = 4.65$ ,  $p < .05$ ). No significant relations to the IVA full-scale Response Control Quotient were found.

**Conclusions:** The current findings suggest that as FSIQ increases, CPTs may not adequately discriminate difficulties with inattention and hyperactivity/impulsivity in real-world settings. Further findings regarding behavior outcomes as they relate to visual and auditory CPT performance will be discussed.

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**J.F. GAMINO, S.B. CHAPMAN, J. HART & S.B. VANEGAS. Improved Reasoning in Children with ADHD after Strategic Memory and Reasoning Training: A Novel Intervention for Strategic Learning Impairment.**

**Objective:** Research in children with ADHD often includes interventions that address medication efficacy and behavioral issues. Both medication and behavioral interventions provide evidence for ameliorating attention, inhibition, and general behavioral concerns.

On the other hand, interventions that address or remediate learning and academic concerns are scarce, in spite of evidence of poor school performance in children with ADHD. In particular, there is little research regarding cognitive interventions that specifically address a child's ability to reason and think critically through selection and synthesis of information into gist-based concepts. We call this reasoning ability "strategic learning." The importance of this ability lies in evidence that gist-based concepts are less susceptible to degradation than verbatim memory.

In a recent study, we found children with ADHD were significantly impaired in strategic learning ability compared to typically developing children. Based on our findings, we developed the Strategic Memory and Reasoning Training (SMART) program for children with ADHD. The aim of this study was to determine the efficacy of intervention in the ability strategically learn in children with ADHD.

**Participants and Methods:** Forty children with ADHD between the ages of 8 and 15 participated in this study. Of the 40 participants, 20 children were included in the SMART intervention and 20 children underwent a behavioral intervention. After 14 45-minute sessions, we retested the children for strategic learning abilities.

**Results:** We found that strategic learning performance significantly improved in the children in the SMART intervention, but the control group did not.

**Conclusions:** This study provides evidence for clinical application in the assessment and remediation of impaired reasoning ability in children with ADHD.

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**P. GONZÁLEZ-PÉREZ, S. HERNÁNDEZ, A. MACHADO, R. MARTÍN, I. QUINTERO & E. VERCHE. Neuropsychological Evaluation of Executive Functions in Children and Adolescents with Attention-Deficit Hyperactivity Disorder (ADHD): A Developmental Perspective.**

**Objective:** Recent structural neuroimaging longitudinal studies have shown delay in cortical development in people with ADHD (Shaw et

al., 2007). Neuropsychological approaches evidence the existence of deficits in executive functions in this population, probably associated with this delay in neurodevelopment (Seidman, 2006). To study the evolutionary pattern of neuropsychological performance in executive functioning in a population with ADHD.

**Participants and Methods:** We have worked with two groups: 32 controls and 31 ADHD, grouped into three age ranges (7-9, 10-13 and 14-17 years); normal IQ and without other neurological or psychiatric disorders. The neuropsychological protocol consisted of: Working Memory Test, COWAT, Stroop Test, Tower of Hanoi and WCST.

**Results:** Data were analyzed by the General Linear Model (GLM). We found significant differences ( $p < 0.05$ ) for the main factors Group and Age, without interaction between them. Specifically we saw a worse performance of ADHD children in verbal working memory, verbal fluency, inhibition, cognitive flexibility and planning. In turn we saw an increase in performance with the age both in controls as ADHD.

**Conclusions:** The results suggest a delay in the acquisition of executive functioning in ADHD, which can improve with age but does not reach the performance of the normal population. These results could be interpreted in terms of a delay in the maturation of cortical thickness that may exceed more than two years of development, as indicated by some authors (Shaw et al. 2007). Future research is needed to validate our behavioral results with neuroimaging techniques.

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**R. MARTÍN, S. HERNANDEZ, A. MACHADO, P. GONZALEZ-PEREZ, I. QUINTERO & E. VERCHE. Assessment of neuropsychological developmental pattern of attention in a population with Attention-Deficit Hyperactivity Disorder (ADHD).**

**Objective:** The traditional clinical description of ADHD emphasizes attention disorder a core symptom. In neuropsychological normal population there is a sequential development of increment in attentional capacities (Klenberg et al., 2001). However, few studies exist about the evolutionary pattern shown in the attentional components in ADHD. The identification of similarities and/or differences in those patterns evidenced both non-ADHD and ADHD have an undeniable therapeutic value. Objective. To study the neuropsychological developmental pattern of attention in an ADHD population.

**Participants and Methods:** 31 ADHD and 32 controls participated in the study, grouped into three age ranges (7-9, 10-13, and 14-17 years), with IQ above 80 and without comorbid neurological and/or psychiatric disorders. The neuropsychological protocol evaluated: Focused attention, selective attention, and sustained attention, both visual and auditory, through: Brickenkamp D2 Attention Test, TMT, and A-Test.

**Results:** Data were analyzed using Manova according to the General Linear Model (GLM). Significant differences ( $p < 0.05$ ) in attentional variables were found for the main factors Group and Age, but not for interaction. This indicates that ADHD has a worse performance in the attentional components evaluated, regardless of the sensory modality of stimulus presentation along with a performance increase in both groups with age.

**Conclusions:** Deficits found in ADHD are presented in both sensory modalities and affect the attentional components evaluated. However, this is not a fixed deficit, but the performance in these variables is progressive according to age, although not reaching normal values. This spontaneous evolution of one of the core symptoms could have an impact on the therapeutical approach. Further investigations are needed in other to study this pathological pattern of the attention development in ADHD.

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**J.B. HALE, L.A. REDDY, S.L. DECKER, R. THOMPSON, E. FORREST, E. EUSEBIO & J. HENZEL. Development and Validation of a 15-Minute Executive Function and Behavior Rating Screening Battery for Children with ADHD.**

**Objective:** Attention problems are ubiquitous in clinical practice, commonly found in many childhood learning and behavior disorders. Practitioners need time-saving and cost-effective methods for determining whether children have Attention-Deficit/Hyperactivity Disorder (ADHD) or another disorder impacting attention and/or executive function. This study details the development and validation of a 15-minute screening battery predicted to discriminate children with ADHD from typical children, and differentiate ADHD subtypes and children with specific learning disabilities (SLD).

**Participants and Methods:** Children aged 6 to 12 years with Inattentive (IT) and Combined (CT) ADHD diagnosed by physicians and independently confirmed by psychologists ( $n = 64$ ), with SLD diagnosed by school teams and psychometric criteria ( $n = 24$ ), and typical children without diagnoses ( $n = 306$ ) were administered the Trail Making Test-Part B (Time/Errors), Hale-Denkla Cancellation Test (Time/Correct), and Child Attention Profile (Inattention/Overactivity) teacher ratings.

**Results:** Screening battery normative data showed a developmental progression of skills and behavior with increasing typical group age. The screen discriminated between typical and ADHD groups (87% correct classification; sensitivity = .64; specificity = .92), and differentiated between IT, CT, and SLD groups (80% correct classification; IT sensitivity = .82 and specificity = .96; CT sensitivity = .84 and specificity = .82). Significant discriminant function and Bonferroni post-hoc results revealed different neuropsychological and behavioral patterns among groups.

**Conclusions:** Multiple ADHD endophenotypes result from behavioral classification methods alone. Normative and discriminant validity data presented provide clinicians with the preliminary behavioral and neuropsychological tools necessary to foster subsequent determination of subtype diagnostic and treatment needs.

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**D.A. JACOBSON, L.A. PAWLUK, R. LAJINESS -O'NEILL, S. NAGEL & S. BOWYER. Regional Cortical Activation Patterns During Continuous Performance Versus Response Inhibition Tasks In Adults With ADHD Subtypes.**

**Objective:** There is limited research examining cortical activation patterns in Attention Deficit Hyperactivity Disorder (ADHD) and ADHD subtypes using magnetoencephalography (MEG). It was hypothesized that differences in cortical activation would be observed between performance on a continuous performance task versus a response inhibition task.

**Participants and Methods:** MEG and MR-FOCUSS (current density technique) (Moran, et al., 2005) were used to identify latencies and amplitudes of magnetic fields associated with performance of tasks involving vigilance, selective attention, and response inhibition. Participants included 11 individuals (Mean Age = 31.7; Males = 5) whose ADHD diagnosis was confirmed using DSM-IV criteria.

**Results:** During early and mid latencies of the CPT condition (120-450ms), predominately left inferior and medial frontal activation occurred. Similar right frontal regions were activated to a lesser degree. Bilateral superior frontal gyri, putamen, and cingulate activated at 120-180ms. Significantly less activation occurred at 400-650ms, but included bilateral OFG/IFG/MFG and bilateral cingulate at 500-600ms. Bilateral temporal activation was noted at 120-160ms (ITG/MTG/STG). During the stroop condition, significant left hemispheric activation occurred in OFG/IFG/MFG/SFG at 120-160ms. From 180-380ms, volleying occurred between the bilateral IFG, MFG, and cingulate. At ~420-650ms, right OFG and MFG activation occurred.

**Conclusions:** Consistent with literature, this suggests hypoactivation in right frontal regions in ADHD, particularly between 120-160ms dur-

ing response inhibition and between 400-650ms during sustained vigilance. Comparisons between subtypes of ADHD and associated patterns of activation on the CPT and stroop will be discussed. Such data will provide insight regarding the neurological substrates of the subtypes of ADHD and may inform future assessment and treatment.

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**N. KROYZER, D. MARCIANO, H. SHWARTZ, R. ZILBER & Y. POL-LAK. Different Aspects of Decision Making Under Uncertainty in Adolescents With and Without ADHD.**

**Objective:** Attention Deficit/Hyperactivity Disorder (ADHD) is a common childhood neurobehavioral disorder. Of concern is the tendency of individuals with ADHD to make maladaptive decisions under conditions of uncertainty. The nature of probabilistic decision making (DM) in ADHD has never been systematically studied, although probabilistic DM is subserved by brain areas and monoaminergic neurotransmitter systems that have also been implicated in ADHD.

**Participants and Methods:** To study the nature of probabilistic DM in ADHD, 32 adolescents with ADHD and 32 control subjects matched in age, gender and IQ, performed a modified version of the Cambridge Gambling Task (Rogers et al., 1999) in which several aspects of probabilistic DM were measured.

**Results:** Results showed differences in the nature of DM between adolescents with and without ADHD. Specifically, compared to controls, subjects with ADHD chose the more favorable outcome less frequently, but tended to risk smaller wagers on the choice. On the other hand, both ADHD and control subjects showed similar trend to adjust the wager to the probability of the outcome, indicating that both groups were sensitive to the meaning of probability. Differences in speed of DM did not reach significance.

**Conclusions:** These results suggest that ADHD is associated with multifaceted profile of DM under uncertainty. Interestingly, this profile is similar to that found in patients with focal lesions of the orbital prefrontal cortex (ORB-PFC) (Rogers et al., 1999), regarding the frequency of choosing the favorable outcome, and the magnitude and adjustment of the wager, suggesting similarity between some aspects of DM in ADHD patients and ORB-PFC patients.

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**H.M. LAMONICA, E. KAPLAN, K. BURSIK & D.A. GANSLER. The Comparison of Adolescent Boys and Girls with Attention Deficit Hyperactivity Disorder, Predominantly Inattentive Type.**

**Objective:** A review of the Attention Deficit Hyperactivity Disorder (ADHD) literature revealed that previous studies have investigated the effects of diagnostic subtype and gender on neuropsychological functioning independently. The current study examined whether there are significant differences between boys and girls with ADHD, Predominantly Inattentive Type (ADHD-I) in DSM-IV symptom prevalence and neuropsychological functioning as measured by scores on Digit Span, Wisconsin Card Sorting Test (WCST), Connors Continuous Performance Test-Second Edition (CPT-II), and Tower Test and Color-Word Interference Test from the Delis-Kaplan Executive Function Scale (D-KEFS).

**Participants and Methods:** The participants were 23 males and 11 females, ranging from 12- to 15-years of age, diagnosed with ADHD-I on the basis of a clinical interview, DSM-IV symptom checklist, and neuropsychological testing. The preliminary results revealed no significant group differences with respect to IQ, age, or grade or in the number of inattentive or hyperactive/impulsive symptoms. Twenty independent sample t-tests were conducted to examine the effect of sex on each dependent variable.

**Results:** The Total Achievement Scaled Score from the Tower Test and the Commissions and Discriminability t-scores from the CPT-II were

found to be significantly different between groups. Correlations revealed the CPT-II variables to be highly correlated and the Commissions t-score was significantly correlated with the Total Achievement Scaled Score. Therefore, after correcting for the inter-dependence of these variables, the proportion of significant to non-significant comparisons is approximately 5% or at the level of chance.

**Conclusions:** These results suggest that adolescent boys and girls with ADHD-I do not differ with regard to symptom prevalence or neuropsychological abilities.

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**D. PETERSON, M. RYAN, M. RICHARDSON, S.M. RIMRODT, L.E. CUTTING & M. MAHONE. Diffusion Tensor Imaging in Children with Attention-Deficit-Hyperactivity Disorder.**

**Objective:** Much is known from structural imaging about the trajectory of cortical maturation in children with ADHD, compared to typically developing children; however, less is known about developmental abnormalities in the underlying white matter. Diffusion tensor imaging (DTI) is an emerging imaging method that provides information on the sub-voxel microstructure of cerebral white matter. Despite the considerable interest in both ADHD and DTI research, there have been very few studies to date that have used DTI to probe microstructural abnormalities that may contribute to the functional deficits observed in individuals with ADHD.

**Participants and Methods:** DTI data were collected on a 3T scanner from nine children with ADHD and eight controls, ages 9-14 years. Fractional anisotropy (FA) images were calculated and normalized by linear transformation of the average diffusion-weighted image to the JHU-DWI template. Voxel-wise statistics were then used to identify regions of group differences.

**Results:** In the ADHD group, a 1.4ml region of increased FA was identified in white matter near the left inferior frontal gyrus at  $p < 0.001$ . Additionally, there were less prominent, but widespread regions of significant FA increase throughout the right hemisphere including the right frontal lobe.

**Conclusions:** Our findings suggest that subcortical white matter abnormalities in the frontal lobe, principally the left frontal lobe, may contribute to the neural substrate of ADHD. Although FA decrease is commonly associated with dysfunction, several recent studies have reported pathological increases of FA in other conditions, e.g., Williams syndrome, highlighting the relevance of DTI in identifying atypical white matter structure associated with neurodevelopmental processes in children.

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**I.H. O'DESKY, A. LOWELL & J. MASSA. Predicting ADHD and ADHD Subtypes with WISC-IV Factor Scores.**

**Objective:** Previous research has evaluated the utility of measuring significant differences among Wechsler Intelligence Scale for Children third- and fourth-editions (WISC-III, WISC-IV) factor scores to predict the presence of Attention Deficit-Hyperactivity Disorder (ADHD), with results most commonly showing low Processing Speed (PSI) and Freedom from Distractibility (FDI)/Working Memory (WMI) scores as reliable indicators. The present study attempted to replicate previous research on the WISC-IV, and to test for significant differences among ADHD subtypes and gender.

**Participants and Methods:** WMI and PSI scores were compared for children with ( $n=99$ ) and without ADHD ( $n=69$ ). Factor subtest scores for Digit Span, Letter Number Sequencing, Coding, and Digit Span were also compared. Children's overall ADHD scores on the Conners' Parent Inventory were examined together and separately by ADHD subtype for both males and females. Comparisons were performed using Pearson Product Moment correlations and independent t-tests.

**Results:** While significant mean differences and negative correlations for PSI and ADHD scores were found, WMI was not a predictive factor for elevated Conners' Parent Inventory scores. Digit Span was reduced for male inattentive children, as was Symbol Search for female hyperactive children.

**Conclusions:** Consistent with prior report children with ADHD have lower PSI scores. Interestingly, the pattern is different for males and females. However, inconsistent with past findings, no WMI differences were found. Future research is needed to compare profiles of children with ADHD and other disorders to examine whether lower PSI scores are specific to ADHD. Additional research is also needed to clarify the WMI controversy.

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**M. MCNALLY, D. CROCKETT, S.J. SUSKAUER & S.F. MOSTOF-SKY. Corpus Callosum Segmental Circumference Correlates with Reaction Time in Children with ADHD but not Typically Developing Children.**

**Objective:** ADHD is associated motor anomalies, and there are inconsistent findings regarding corpus callosum (CC) morphology in ADHD. We investigated the relationship between CC morphology and reaction time (RT) in children with ADHD compared to typically developing (TD) children.

**Participants and Methods:** CC measurements were obtained for 64 children with ADHD and 64 TD controls aged 7 to 13 years; groups were age and gender-matched. CC was isolated on the midsagittal section of a high-resolution T1-weighted image; an automated procedure divided the CC into 5 segments for which area and circumference were calculated. Measurements were normalized to total cerebral volume. 56 children with ADHD and 45 TD children completed a simplified Go/No-go task. Average RT was calculated for correct responses to Go stimuli.

**Results:** There were no significant between-group differences in CC segment areas or circumferences. Segment areas and RT were not correlated. In the children with ADHD, RT correlated with mid-body and isthmus circumferences ( $r=0.4$ ,  $p=0.002$  for both). Segment circumferences and RT were not correlated in the TD children.

**Conclusions:** Our analysis indicates a relationship between RT and isthmus and mid-body circumferences, but not areas, in children with ADHD but not TD children; this suggests that the shape of these segments may be important in ADHD. As these segments include primary motor and premotor projections, these findings may provide insight into anomalies of motor/premotor function associated with ADHD. Future evaluation of CC segment shape in children with ADHD and TD children will improve our understanding of these findings.

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**G.R. MESMAN, S.L. LANCASTER & M.Y. KIBBY. Rapid Naming Deficits in Children with ADHD-PI and ADHD-C.**

**Objective:** Research suggests children with ADHD struggle with rapid automatic naming, particularly with rapid object naming; however, limited research has examined subtypes of ADHD.

**Participants and Methods:** Participants included 101 children, ages 8 to 12 years, with ADHD-PI ( $n = 28$ ), ADHD-C ( $n = 20$ ) or controls ( $n = 53$ ). Participants completed a neuropsychological evaluation as part of a larger study (R03 HD048752). The CTOPP was used to measure rapid object naming (RON) and rapid letter naming (RLN).

**Results:** Groups were comparable in age ( $p > .10$ ) but differed in sex and WISC FSIQ ( $ps < .05$ ). Controls had significantly higher FSIQ scores than the ADHD-PI group but not the ADHD-C group. The two ADHD groups were comparable in FSIQ. There were more males than females in the ADHD-C group. The MANCOVA controlling sex and FSIQ was not significant, Wilks'  $\Lambda = .98$ ,  $F(4, 186) < 1.0$ . Although there were no group differences on RLN or RON, children with ADHD performed below average on the RON. Controls, however, had a mean standard score

of 90 on the RON. All groups scored in the mid-90s on RLN. Further analyses were conducted to examine differences in RLN and RON performance within groups using paired *t*-test. Everyone, ADHD-PI,  $t(27) = 3.70$ ,  $p = .001$ , ADHD-C,  $t(19) = 3.14$ ,  $p < .01$ , and controls,  $t(52) = 3.06$ ,  $p < .01$ , scored better on RLN than RON.

**Conclusions:** Controls, in addition to children with ADHD, may have more difficulty with RON than rapid phonological retrieval as the CTOPP is currently normed.

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#### L. CHAPMAN, C.A. NOGGLE, K. BAXTER, C. SADLER & R.S. DEAN. Divergent Achievement Profiles of ADHD and Bipolar Disorder.

**Objective:** ADHD-Combined type and Bipolar disorder in pediatric populations often present with a general overlapping of functional symptomatology. Aside from similarities in behavioral presentations, both have been found to relate to cognitive as well as academic deficits. While previous research has demonstrated some areas of differentiation on cognitive measures (e.g. Myers-Pagoria et al., 2007), less has been reported on discrepancies in the achievement profiles. The current study compared the performance of children diagnosed with Bipolar disorder to those diagnosed with ADHD-Combined type on the WJ-III Tests of Achievement to determine if such differences exist.

**Participants and Methods:** An archival data asset was utilized for the present study. Participants included 116 children diagnosed with ADHD-Combined type and 72 diagnosed with Bipolar I Disorder who were administered the WJ-III Tests of Achievement as part of a full neuropsychological assessment.

**Results:** Multivariate analysis revealed significant discrepancies did in fact exist between groups,  $F(12, 175) = 2.796$ ,  $p = .002$ . A significant discriminant function resulted with a combined  $\chi^2(12) = 31.571$ , demonstrating greatest differentiation ( $>.30$ ) between groups was found on spelling, letter-word identification, and math fluency with the ADHD group performing worse than those with Bipolar I.

**Conclusions:** Results are not only important in that they identify clear discrepancies between these clinical groups within academic domains, but they may carry clinical implications as well. Specifically, while differential diagnostic practices most commonly rely on cognitive-based measures, results may suggest that incorporation of achievement-based measures may offer additional data of reliable comparison. Additional implications and results will be offered.

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#### K.M. O'BRIEN, E.J. MASSEY, N.A. BUTLER, S. KERCOOD & T.T. LINEWEAVER. Visual Distraction Negatively Impacts Both Auditory and Visual Working Memory in College Students with ADHD.

**Objective:** We evaluated how visual distraction impacts auditory and visual working memory (WM) in college students with Attention Deficit Hyperactivity Disorder (ADHD).

**Participants and Methods:** Thirty-nine students (ADHD  $n=24$ ; control  $n=15$ ) completed two auditory [Digit Span (DS), Paced Auditory Serial Addition Test (PASAT)] and two visual [Spatial Span (SS), 2-back and 3-back] WM tests. We tested half of the participants next to a laptop screen displaying a series of candid photos of college students. Remaining participants sat by an open laptop with a blank screen.

**Results:** For each test, we ran a 2 (task difficulty) X 2 (distraction) X 2 (diagnosis) repeated-measures ANOVA. Participants' auditory WM was worse in the presence of distractions (DS  $p < .05$ ; PASAT  $p < .05$ ). For DS, students with ADHD were more easily distracted than controls ( $p = .05$ ), and a near significant trend ( $p = .089$ ) for this difference to be larger when the test was more difficult (backwards vs. forward) emerged. Participants performed better on the 3-second than the 2-second PASAT

( $p < .000$ ), and, although not quite significant, the faster pace was more detrimental to the ADHD than the control group ( $p = .07$ ). For visual WM tests, neither distraction nor diagnosis affected SS. However, the three-way interaction reached significance for the N-back ( $p < .05$ ); students with ADHD were more easily distracted than the control group, and this effect was more pronounced with increased task difficulty (3-back v 2-back).

**Conclusions:** Results indicate that college students with ADHD are more vulnerable to visual distractions than their non-affected peers and that this effect extends beyond WM tasks that demand visual attention.

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#### S. PATANKAR & T. ATCHISON. Neuropsychological Assessment of Caffeine's Effect on Attention.

**Objective:** Previous studies have focused on caffeine's effect on attention as being a unitary construct. In addition, studies of caffeine's effect on attention have resulted in inconsistent findings. This study examined the effects of moderate caffeine using the attention model proposed by A.F. Mirsky, suggesting that attention is a multi-modal construct, influenced by different aspects of brain functioning. Neuropsychological testing would assess the focus/execute, sustain, shift, encode and stabilize elements of the attention model to indicate differential effects of caffeine on attention.

**Participants and Methods:** Seventy one participants were randomly assigned to the caffeine ( $N=36$ ) and the placebo condition ( $N=37$ ). The treatment group consumed orange juice containing caffeine (4mg/kg). All participants were administered neuropsychological tests comprising of the RAVLT, Stroop, Digit Span, CPT and WCST. The scores were analyzed individually for all the attention elements.

**Results:** No significant differences were observed in the elements of attention between groups. However, the stabilize element approached significance as caffeine consumers had more consistency in the response speed on the CPT,  $F(1, 69) = 3.608$ ,  $p = .062$ .

**Conclusions:** Results indicate the need for further investigation of caffeine's potential for a differential effect on the stabilize aspect of attention. This may provide evidence that the attention system, though primarily working as a unitary system, is supported by individual elements that indicate a multi-modal process. Further investigation of the brain regions supporting this element is needed to clarify the effect of caffeine on this element of attention.

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#### B. RUBIO, R. MARTÍN, P. GONZÁLEZ-PÉREZ, . HERREROS, I. QUINTERO & S. HERNÁNDEZ. Has Methylphenidate-OROS Differential Neuropsychological Effect in ADHD Children With and Without Comorbid Disorder?: Preliminary Results.

**Objective:** 1. To assess if methylphenidate-OROS (MPH-OROS) has a potential effect increasing working memory (WM) and attention parameters in ADHD children, 2. To assess whether MPH-OROS has a differential effect on executive function in ADHD with and without comorbid disorders.

**Participants and Methods:** 12 children were selected and grouped according DSM-IV-TR criteria to ADHD (Age=9,17; SD=2,33), (6 ADHD, 6 ADHD+comorbid disorder) and 11 control children (Age=9,17;SD=1,95). Materials: D2 Brickenkamp Attention Test; WM Test of Siegel & Ryan; Digits of WISC III-R; Visual Memory Span of WMS-R; ADHD-RS-IV; Conners Rating Scale; WISC, K-BIT. We use Group (ADHD, ADHD+, Controls) and Moment (Naive, one doses, one month doses) as intergroup factors, treated with MPH-OROS. Neuropsychological battery was administered in patients naive ADHD, after one doses, after one month doses, and control group.

**Results:** Data were analyzed using General Lineal Model (GLM). Differences were found in WM after one month of daily treatment with

MPH-OROS and attention parameters after only one dose in ADHD group. Differences between naive ADHD and control group in WM were statistically significant at the beginning, but not before one month of daily treatment. When we analyze these differences related to ADHD subgroups (with or without comorbid disorders) we found a greater benefit in ADHD without comorbid disorders group.

**Conclusions:** MPH-OROS improves attention after the first dose and working memory after one month of daily treatment in people with ADHD. However, when children with ADHD suffer a comorbid disorder, the drug effectiveness in improving neuropsychological performance is significantly smaller.

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**M. SHANAHAN, C.H. MORTON, B. KOPALD, J. STRICKLAND & L.D. STANFORD. The Relationship between Written Expression and Executive Dysfunction in Children with ADHD.**

**Objective:** Many children with ADHD have difficulty with written expression although there are few published research studies on this phenomenon. It is less clear whether children with ADHD struggle with writing due to the language, executive, or fine motor demands, or some combination thereof. The present study utilizes a model which includes all three of these domains to determine the relative contribution of each.

**Participants and Methods:** Participants included 61 clinically-referred children with ADHD. All participants were administered tests of higher order language abilities (i.e., WISC-IV VCI), writing skills (i.e., WJ-III Writing Samples and Writing Fluency), visual motor integration (i.e., Beery VMI), fine motor functioning, and attention/executive functioning (i.e., TEA-Ch).

**Results:** The model significantly predicted written expression scores ( $F(4,43)=23.59, p<.001, \text{adjusted } r^2=.68$ ), with executive function ( $\text{Beta}=.49, p<.001$ ) and verbal reasoning abilities ( $\text{Beta}=.40, p<.001$ ) emerging as significant predictors. Fine motor skills and visual motor integration did not significantly predict written expression in this sample. In order to further characterize the nature of the relationship between executive functioning and written expression in children with ADHD, TEA-Ch scores were subdivided into selective attention, divided attention, and inhibition. Of these three, only selective attention significantly predicted written expression scores ( $\text{Beta}=.53, p<.001$ ).

**Conclusions:** In sum, these results indicate that for children with ADHD, deficits in written expression are accounted for by executive dysfunction as well as higher order verbal reasoning abilities but not by visuomotor construction. These results have important implications for the assessment and treatment of written expression difficulties in children with ADHD. Correspondence: *Michelle Shanahan, UIC Medical Center, 912 S. Wood St., Chicago, IL 60612. E-mail: mshanahan@psych.uic.edu*

**S.K. STERN, A. BLALOCK & M.K. MORRIS. Patterns of DKEFS Performance Predict Reading Disability But Not ADHD.**

**Objective:** The Delis-Kaplan Executive Function System is a battery of well-researched tests developed to assess components of executive functioning (EF). Impaired executive functioning has been reported in both children and adults with attention-deficit/hyperactivity disorder (ADHD), but patients with other developmental disorders may also perform poorly on these measures secondary to deficits in executive and/or non-executive component processes. This study evaluates the ability of selected DKEFS subtests to accurately classify participants diagnosed with reading disability (RD) and ADHD.

**Participants and Methods:** Sixty-four college students referred to an on-campus clinic, who met criteria for either RD or ADHD, were administered three DKEFS subtests (Trail Making, Verbal Fluency, and Color-Word Interference). Three separate hierarchical logistical regression analyses were conducted to evaluate their predictive utility. Age was entered first in each model, followed by raw scores on conditions assessing component processes, with scores on executive conditions entered in the final step.

**Results:** Age was a significant predictor in each analysis. The Number-Letter Switching condition of Trail Making and the Letter Fluency condition of Verbal Fluency were also significant predictors of group membership in final model steps. No condition of Color-Word Interference significantly improved classification accuracy. In each model, RD was more accurately classified (81-86%) than ADHD (58-69%).

**Conclusions:** DKEFS subtests assessing EF may not have adequate specificity to differentiate ADHD from other developmental disorders. Other disorders may be characterized by deficits in either component or executive processes that impact DKEFS performance.

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**J. WASSERSTEIN, M.V. SOLANTO, D.J. MARKS & K.J. MITCHELL. Profile Of BRIEF Self-report Results In Adults With ADHD.**

**Objective:** The BRIEF scale measures reports of theoretically delimited dimensions of executive functions (EF), as seen in everyday life, and has been used to analyze EF profiles in various clinical populations. Although deficits in EF are thought to be central in ADHD, psychometric studies of EF in ADHD adults usually show only weak effects and do not measure the more routine life tasks assessed by the BRIEF. There are no published studies using the BRIEF in ADHD adults and this study addresses the gap.

**Participants and Methods:** 88 adults (mean age 41, mean education 16 years, mean IQ 117) meeting strict research criteria for ADHD (e.g., CADDID and CARRS) were evaluated as part of baseline assessment in a funded treatment study. Both major ADHD subtypes were well represented (1/3 Combined and 2/3 Inattentive) and had equal medication status (roughly 50%).

**Results:** Overall the sample showed poor EF ( $T = >65$ ) on most subscales (7/9) and all Indices (3/3). Surprisingly, Self-monitoring and Emotional Control were relatively more intact ( $T=62$ ). Most EF scales were significantly interrelated (9/9), although Organization of Materials and Initiation were less so (4/9 and 5/9). Overall the Metacognitive Index (MI) was significantly worse than the Behavioral Regulation Index (BRI) ( $T=30$  vs 67). Moreover, both ADHD subtypes were almost universally impaired for MI (>90%), while the Combined type showed significantly more problems with BRI (76% vs 41% in the Inattentives).

**Conclusions:** These data argue that EF deficits are extremely common in adults with ADHD and may need to be assessed via tools which evaluate more lifelike manifestation of EF skills. Executive dysfunction in ADHD may be particularly prominent in the metacognitive domain (especially working memory, planning and task monitoring), perhaps pointing to neuropathology shared across types. By contrast deficits in behavioral regulation (including the inhibition, which is central to some models of ADHD) are more variable and may be more subtype specific. Correspondence: *Jeanette Wasserstein, PhD, Mt. Sinai Medical College, 1150 Fifth Ave, suite 112, New York, NY 10029. E-mail: cnsync@aol.com*

**Assessment/Psychometrics/Methods  
(Child)**

**J.T. BEETAR. Perceptual Organization versus Perceptual Reasoning in a Clinic Sample.**

**Objective:** To compare the performance of children and adolescents referred to an outpatient clinic for neuropsychological testing on the WISC-III Perceptual Organization index and the WISC-IV Perceptual Reasoning index.

**Participants and Methods:** The sample was comprised of individuals with a variety of medical and DSM-IV diagnoses. The former included spina bifida, epilepsy and traumatic brain injury; the latter included ADHD, learning disorders, and mental retardation. Thirty-six outpatients were administered the WISC-III and 64 participants were given the WISC-IV.

**Results:** A one-way analysis of variance with groups ( $n = 2$ ) as the independent variable and index score as the dependent variable yielded an insignificant difference between groups.

**Conclusions:** The Perceptual Organization index of the WISC-III was restructured and changed to Perceptual Reasoning on the WISC-IV. This revision was made to deemphasize speed on selected subtests of generally nonverbal ability. However, based on the current finding, there is no difference in performance in this clinic sample regardless of measure used.

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**B.L. BROOKS, G.L. IVERSON, E.M. SHERMAN, J.A. HOLDNACK & T. CAYTON. Base rates of low scores in pediatric neuropsychology: Part I. Prevalence of low Index scores on the Children's Memory Scale (CMS).**

**Objective:** It is common for healthy people to obtain some low scores across a battery of tests. The purpose of this study is to examine the prevalence of low Index scores on the Children's Memory Scale (CMS; Cohen, 1997) in healthy children and adolescents.

**Participants and Methods:** Participants included children and adolescents ( $N=1,000$ ; 5-16 years) from the CMS standardization sample. The CMS consists of eight age-adjusted Index scores – only six of the Indexes were used for these analyses (i.e., Learning, Verbal Immediate, Visual Immediate, Verbal Delayed, Verbal Delayed Recognition, and Visual Delayed). A subsample of the participants ( $n=209$ ) also received a measure of intellectual abilities (WISC-III) as part of a linking study.

**Results:** When performance on the six Index scores was considered simultaneously, 45.6% of children and adolescents had one or more Index scores  $\leq 16$ th percentile and 12.4% had one or more extremely low Index scores (i.e.,  $< 2SDs$ ). The prevalence of low Index scores was fairly consistent across the age groups, but low memory scores occurred more often in those with lesser intellectual abilities. For example, 73.3% with below average intellectual abilities obtained one or more Index scores  $\leq 16$ th percentile compared to 48.4% with average and 23.3% with above average intellectual abilities.

**Conclusions:** This is the first study examining the base rates of low scores on a pediatric memory battery. Similar to adults, obtaining some low scores is common in healthy children and adolescents. Knowing the prevalence of low CMS Index scores should improve diagnostic accuracy with children and adolescents.

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**B.L. BROOKS, G.L. IVERSON, E.M. SHERMAN, J.A. HOLDNACK & T. CAYTON. Base rates of low scores in pediatric neuropsychology: Part II. Prevalence of low subtest scores on the Children's Memory Scale (CMS).**

**Objective:** Obtaining some low scores on a neuropsychological battery is not only common in healthy people, it is expected. The purpose of this study is to examine the prevalence of low subtest scores on the Children's Memory Scale (CMS; Cohen, 1997) in healthy children and adolescents.

**Participants and Methods:** Participants included children and adolescents ( $N=1,000$ ; 5-16 years) from the CMS standardization sample. The CMS consists of four age-adjusted primary subtests (i.e., Stories, Word Pairs, Dot Locations, and Faces). A subsample of the participants ( $n=209$ ) also received a measure of intellectual abilities (WISC-III) as part of a linking study.

**Results:** On the immediate memory subtests, 69% of children and adolescents had one or more scores  $\leq 16$ th percentile and 13% had one or more frankly impaired scores (i.e.,  $< 2SDs$ ). On the delayed memory subtests, 57% of children and adolescents had one or more scores  $\leq 16$ th

percentile and 15% had one or more frankly impaired scores. Low subtest scores were more common in those at lower intellectual levels. For example, 73% with below average intellectual abilities obtained one or more immediate memory scores  $\leq 16$ th percentile compared to 33% with above average intellectual abilities. Regarding delayed memory scores, 80% with below average intelligence and 50% with above average intelligence obtained one or more subtest scores  $\leq 16$ th percentile.

**Conclusions:** Low subtest scores were common in healthy children. This suggests caution in interpreting low CMS subtest scores as sole evidence of memory impairment. Knowing the prevalence of low scores in healthy children and adolescents will reduce the likelihood of misdiagnosing memory problems.

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**C.A. COLE, J.H. SANZ, C. VON THOMSEN, R. MARTIN, E. MAHONEY & T. ZABEL. Ceiling Effects in the VMI-5 and TVP among Typically Developing Children.**

**Objective:** The Beery Buktenica Test of Visual-Motor Integration – Fifth Edition (VMI-5) and Test of Visual Perception (TVP) are commonly used to assess visual/graphomotor skills and monitor progress over time. We investigated the potential for artificial score attenuation with age, as published normative data suggest a potential ceiling effect for children 15 years and older (e.g., subjects ages 15-18 can only obtain a standard score of 100 or higher if they miss one or fewer of the 30 total test items).

**Participants and Methods:** We recruited a carefully screened sample of typically developing children ( $N=39$ , ages 6-18) without overt behavioral/psychological disorders (DICA-IV) or developmental delay (PPVT-III $>70$ ) to participate as a control group. Each participant completed the PPVT-3, VMI-5, and TVP as part of a larger test battery.

**Results:** Correlation analyses revealed strong negative correlations between age at time of assessment and standard scores on the VMI-5 ( $r = -.67, p < .00$ ) and TVP ( $r = -.70, p < .00$ ), while a weak (insignificant) negative correlation was observed between age and standardized PPVT-3 scores ( $r = -.27, p < .09$ ). MANOVA revealed significant differences when standard scores on the VMI-5 and TVP (but not the PPVT-3) for younger (ages 6-11,  $n=19$ ) and older (ages 12-18,  $n=20$ ) participants were compared.

**Conclusions:** These findings support an age-related ceiling effect for the VMI-5 and TVP in typically developing youth. Standardized scores from the VMI-5 and TVP may underestimate the abilities of individuals over the age of 12, and erroneously suggest a pattern of skill decline in the serial assessment of older adolescents.

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**K.A. ESPY, S. WIEBE & T. SHEFFIELD. Test-retest reliability for new tasks to assess executive control in preschoolers.**

**Objective:** There remain comparatively few instruments to assess executive control in preschool children, particularly those with known psychometric characteristics that render them suitable for application with clinical populations.

The objective was to evaluate the temporally stable reliability in a number of new tasks adapted, revised, and/or developed to assess executive control in preschoolers.

**Participants and Methods:** Participants were 31 typically-developing preschoolers ( $M = 4.5$  years,  $SD = .9$ ), 54% girls, 74% Caucasian. Preschoolers were administered a child friendly battery of executive control tasks, including a revised 9-boxes, modified Big-Little Stroop; revised Delayed Alternation, Go-NoGo; revised Extra-dimensional Reversal task, Nebraska Barnyard, revised Snack Delay, and revised Trails-Pr. The battery was readministered to the same children an average of 2 weeks later. Test-retest stability was calculated using the Intra-class correlation or Spearman's correlations.

**Results:** Test-retest reliability was in the clinically acceptable range for Big-Little Stroop (.85), Go-NoGo (.74, .83), Nebraska Barnyard (.87), modified Snack Delay (.85), and Trails-Pr (.72). Unfortunately, despite modification, 9-Boxes and the Extradimensional Reversal task continued to have unacceptable levels of performance stability (.25 and .40, respectively). Finally, despite the addition of pretest training to criterion, Delayed Alternation demonstrated significant, but less than acceptable, performance stability (.55).

**Conclusions:** Even in preschoolers, it is possible to develop executive tasks with clinically acceptable stability in performance through careful manipulation and systematic investigation. These new tools hold promise to better elucidate the pathways to problem outcomes in young children at risk to due developmental, neurological, or psychiatric disorder.

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#### G.A. GIOIA, J.A. JANUSZ, C. MCGILL & R. TAMAROFF. Examination of Normative Symptom Reports by Non-Injured Children and Their Parents.

**Objective:** Evaluate psychometric properties of parent- and child post-concussion symptom reports.

**Participants and Methods:** 570 non-injured typical children (64% male), age 5-12, and their parents. Younger children (5-7 years) rated 13 symptoms, age 8-12 ( $n=466$ ) 25 cognitive, somatic, and emotional symptoms on a 3-point (None, A Little, A Lot) Likert scale. Parents rated 26 symptoms on a 7-point Likert scale. Analyses included scale reliability, factor structure, baseline symptom frequency, and parent/child correlation.

**Results:** Few symptoms were endorsed by parents or children 8-12; none was rated as significant problem by greater than 10% of the sample. In contrast, symptoms were reported more frequently by children age 5-7, with greater than 10% of the sample rating 6 symptoms as a frequent problem ("A lot"). Overall, fatigue was the most common symptom, endorsed by 20% of the sample. Internal consistency reliabilities were adequate for all three scale versions ( $\alpha=0.80-0.90$ ), and a multi-factorial structure was identified for each scale. Parent-child total symptom score correlations ( $r=0.09-0.16$ ) were low.

**Conclusions:** Analysis of baseline symptoms indicates younger children endorse a greater frequency of low levels of symptoms than older children or their parents. There may be a difference in how younger children understand or interpret symptom-based questions. This study highlights the importance of obtaining symptom report about a pediatric concussion from various sources. Further, with the high percentage of symptom reports in a non-injured population, pre-injury ratings of symptoms is warranted. Further examination of parent and child symptom reports in an injury sample is underway.

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#### E.J. HELDER, M. BEHEN, S. HALVERSON, A. BHATT & H. CHUGANI. Neuropsychological and Behavioral Outcomes in Children with Histories of Early Deprivation: Impact of Country of Adoption.

**Objective:** Early deprivation associated with orphanage rearing has been linked to cognitive and socio-emotional difficulties. Several studies of international adoptees have reported better outcome in individuals adopted from South Asian countries. However, these studies have not controlled for age at adoption which has an important impact on outcome. The current study examined the impact of country of adoption on neuropsychological and behavioral outcomes in this population.

**Participants and Methods:** Forty-eight children were included in the study (mean age=108+32 months); twelve adopted from South Asian

countries (mean duration=15.2+4.9), 19 from Eastern Europe (mean duration=20.9+6.9), and 17 from Russia (mean duration=19.8+4.5). All children received a neurological exam and a comprehensive neuropsychological evaluation. Age at adoption and gender were included as covariates in group comparisons.

**Results:** The overall MANCOVA for the neuropsychological and behavioral domains was significant ( $p=0.04$ ). Follow-up tests revealed that Eastern European adoptees scored significantly lower than South Asian adoptees on global and all four indices of intellectual functioning, receptive and expressive language, verbal memory, and academic achievement. The Russian adoptees scored significantly lower than South Asian adoptees only with regard to verbal memory. The South Asian adoptee group was also rated as having fewer externalizing symptoms compared to both other groups.

**Conclusions:** South Asian adoptees tended to fare better than Eastern European and, to a lesser extent, Russian adoptees, on measures of verbally mediated neurocognitive tasks and behavioral functioning. Findings may be attributable to a number of factors and have implications for the generalizability of other research examining children adopted from orphanage settings.

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#### B.D. HILL, L. HINES, T. OWENS & J.R. O'JILE. The Relation of Depression and Anxiety to Measures of Executive Functioning in Children and Adolescents.

**Objective:** The amount of variance accounted for by mood in executive functioning measures has not previously been reported in children and adolescents. The few papers in this area have focused exclusively on group differences. Based on the adult literature, we hypothesized that self-reported depression and anxiety would not account for any significant amount of variance on measures of executive functioning in this group.

**Participants and Methods:** 81 children and adolescents age 7-15 years (mean 10.9, SD 2.59) with  $IQ>70$  participated in this study. Ethnicity: 57% Caucasian, 37% African-American, and 4% Native American. Measures: Children's Depression Inventory (CDI), State-Trait Anxiety Inventory for Children (STAI-C), Trails parts A and B, Wisconsin Card Sorting Test (WCST), NEPSY Tower, COWAT (FAS and animals), and Digit Span.

**Results:** Power analysis determined that study power was sufficient to detect a moderate effect size. Multiple regression analyses were then used. To control for developmental effects, age was entered on the first step of each analysis. The amount of variance accounted for by the CDI and STAI-C (both state and trait) separately beyond age for each executive measure was assessed. CDI and STAI-C scores accounted for <2% of the variance on most measures. Identical results were found in subgroup analyses examining elevated mood endorsement. The only exception was STAI-C trait scores significantly accounted for 5-8% of the variance on WCST, NEPSY Tower, and COWAT animals. Trait anxiety caused an increase in WCST perseverative errors but facilitative effects were noted on Tower and COWAT animals. Additionally, no synergistic effect of depression and anxiety was found for any of the measures.

**Conclusions:** Impaired performance on measures of executive functioning in children and adolescents appears to be minimally related to self-reported depression and anxiety symptoms. For specific tests, anxiety may decrease performance on the WCST but appears to improve performance on NEPSY Tower and COWAT animal naming.

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#### C.G. VAUGHAN, D.T. VINCENT, E. LEAFFER, J.C. SCHNEIDER, R.M. ROTH, P.K. ISQUITH & G.A. GIOIA. Psychometric Properties of a Computer Administered Working Memory and Inhibitory Control Battery for Children.

**Objective:** We examined psychometric properties of a new computer administered test of working memory and inhibitory control.

**Participants and Methods:** 977 typically developing children (63% male) aged 5 to 18 completed a novel computer administered task, combining an N-back paradigm (0, 1, 2-back) to assess working memory with a go/no-go paradigm to assess inhibitory control across 6 conditions with three alternate forms.

**Results:** Response accuracy (ACC) increased and response time (RT) and RT variability (SD) decreased linearly with age. Boys responded slightly faster while girls were slightly more accurate, but only on easier tasks ( $\eta^2 < .05$ ). There were no meaningful differences ( $\eta^2 < .01$ ) for race/ethnicity. There were no systematic differences between the three alternate forms. Split-half reliability was appropriate for ACC (.76 - .80) and RT (.68 - .82), with more variability for SD (.47 - .67) and ICV (.45 - .67) across conditions. Test-retest stability was high for ACC (.82 - .90), and initially high for RT, SD and ICV (.75 - .80) with lower reliability on the 2-back condition (.54 - .77). Participants became less accurate and more variable with increased working memory load, and slowed in their response times dramatically with the addition of inhibitory demand.

**Conclusions:** A new measure of working memory and inhibitory control shows appropriate internal consistency and temporal stability, while remaining sensitive to developmental changes in children 5 to 18 years. Parametrically increasing working memory and inhibitory load resulted in slower response time, greater variability, and lower accuracy overall. Correspondence: *Peter K. Isquith, Ph.D., Department of Psychiatry, Dartmouth Medical School, 367 Route 120 Unit B1, Lebanon, NH 03766. E-mail: Peter@QPsych.com*

**J. KAUFMAN, S. WARSCHAUSKY, M. VAN TUBBERGEN, S. AS-BELL & J. DONDERS. Modified Assessment of Visual Inspection Time in Children with Cerebral Palsy.**

**Objective:** Inspection Time (IT) has been studied extensively as a measure of general speed of processing. IT tasks typically are computerized and amenable to assistive technology interfaces for accessibility. This study examined the feasibility of standard versus modified IT procedures for use with children with cerebral palsy (CP).

**Participants and Methods:** Participants were 8 children with CP (3 hemiplegic, 3 diplegic, 2 other) and 6 typically developing (TD) peers, ages 8-16, mean 10.7 (2.5) years. Six were at GMFCS level III-V. Standard and modified IT tasks consisted of pi stimuli presented on a computer screen for controlled brief lengths of time, e.g. 50ms. Examinees were asked to make a simple decision regarding visual properties, with IT estimated using a modification of the Wetherill and Levitt stepwise technique. Testing was preceded by a graduated training procedure. Responding was nonverbal, with standard responding using arrow keys and modified responding with option autoscanning and use of a pressure switch to indicate choice.

**Results:** The bivariate correlation between modified and standard IT scores was statistically significant,  $r = .68$ ,  $p < .01$ , with preliminary evidence of limited measurement agreement, ICC = .67. Nonparametric testing indicated significant group differences in adapted IT thresholds, with significantly slower IT in the CP group. Differences in standard and adapted IT scores were not statistically significant.

**Conclusions:** Findings provide preliminary evidence to support the feasibility of a modified IT procedure to assess speed of processing in children with CP who are unable to provide reliable motoric or verbal responses.

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**R. MARTIN, C. TIGERA, E.M. MAHONE & M.B. DENCKLA. Factor Structure of Timed Motor Examination and Relationship with IQ.**

**Objective:** Brain systems supporting higher cognitive and motor control develop in a parallel manner and depend on functional integrity and maturation of related regions, suggesting neighboring neural circuitry.

Children with neurodevelopmental disorders commonly present with motor dysfunction; thus, concurrent examination of motor and cognitive control can provide a window into neurological development. Identifying performance-based measures independent of IQ, however, can be a challenge. This study examined the relationship between IQ and components of standardized timed motor examination in large clinical and control samples.

**Participants and Methods:** Timed motor performance from the PANESS (Denckla, 1985) and IQ scores from 324 right-handed controls plus 170 children from an outpatient neuropsychology clinic, ages 6-16, were analyzed. Timed activities: three repetitive movements (toe-tapping, hand-patting, finger-tapping) and three patterned movements (heel-toe tap, hand pronate/supinate, finger sequencing), each performed on the right and left, were included in an exploratory factor analysis.

**Results:** Among typically developing children, factor analysis yielded two factors—repetitive and patterned movements, with FSIQ significantly correlated with the patterned factor ( $r = .12$ ,  $p = .04$ ), but not with the repetitive factor ( $r = .01$ ;  $p = .80$ ). Factor analysis within the clinical group yielded three factors—all significantly correlated with FSIQ: repetitive ( $r = -.31$ ,  $p < .01$ ), patterned ( $r = -.38$ ,  $p < .01$ ), plus a non-dominant finger sequencing factor ( $r = -.26$ ,  $p < .05$ ).

**Conclusions:** Among typically developing children, repetitive timed tasks may be independent of IQ; however, patterned tasks share more variance, implying shared neural substrates. Among neurologically vulnerable populations, both patterned and repetitive movements covary with IQ, suggesting that motor speed in these children is more indicative of underlying neurological integrity.

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**C.A. NOGGLE, C. SADLER, L. CHAPMAN & R.S. DEAN. Utility of the Clock Drawing Task on the Dean-Woodcock Neuropsychological Battery as a Cognitive Screener in a Pediatric Population.**

**Objective:** Evidence has suggested clock drawing tasks are good cognitive screeners as many skills are required for completion (Royall et al., 1998) and they are generally less time consuming than other screeners (Bush et al., 2001). While the clock drawing task has been prominently used in adult populations, less has been reported on its use as a cognitive screener in children. The current study investigated the utility of the clock drawing task on the DWNB as a cognitive screener in children.

**Participants and Methods:** An archival data set was utilized for the present study. Participants included 273 children who were referred for neuropsychological assessment and as part of that evaluation were administered the clock drawing task on the Dean-Woodcock Sensory-Motor Battery as well as the seven core subtests of the WJ-III-Cognitive and three supplementary subtests.

**Results:** Regression analyses revealed a significant relationship ( $p < .01$ ) between children's performance on the clock drawing task and their overall cognitive outcomes. Additional analyses, however, revealed discrepancies between subtests' relationships to performance on clock drawing. Specifically, significant ties to performance on the clock drawing task was found with verbal comprehension, spatial relations, sound blending, concept formations, visual matching, incomplete words, picture recognition, and analysis-synthesis. No significant relationship was found between the clock drawing task and performance on numbers reversed and/or visual-auditory learning.

**Conclusions:** Results clearly attest to the utility of the clock drawing task as a screener of broader cognitive functioning, as well as more domain specific abilities, in pediatric populations which carry both scientific and clinical implications.

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**M.A. PROSJE, L.R. MUSKAT, M.W. WIESEL-LEARY & N.A. DE-FILIPPIS. A Psychometrically Rigorous Examination of Pediatric Neurological Soft Signs in 8, 9, and 10 year-olds.**

**Objective:** Some researchers have proposed an inverse relationship between the incidence of neurological soft signs (NSS) and age. Investigators have cited statistically significant decreases in abnormalities in thumb-finger opposition, rapidly repetitive hand movements, graphesthesia, and tandem walk with increasing age. Unfortunately, methodological weaknesses limit direct comparison across studies. This psychometrically rigorous study examined the impact of age on performance of five tasks commonly used to assess NSS in children.

**Participants and Methods:** Five tasks measuring NSS (thumb-finger opposition, rapid alternating pronation-supination/dysdiadochokinesia, fist-edge-palm sequence, fingertip number or symbol writing perception/graphesthesia, and tandem heel-to-toe-walking) were administered to 105 children ages eight (n=36), nine (n=32), and ten (n=37). The sample was comprised of children from a rural school district with various special educational needs (n=65) (e.g., learning disability, emotional/behavioral disturbance) and normal age-matched controls (n=40). Standardized task administration procedures, scoring criteria, and examiner training were devised to maintain psychometric rigor.

**Results:** Analysis of variance (ANOVA) was utilized to compare the performance of children based on age. The ANOVA revealed significant between group differences for the graphesthesia task,  $p=.00$ . Interrater reliability was excellent for the first four tasks, ICC (3,2)  $r=.972$ , and excellent to good for tandem heel-to-toe walking,  $.70 < r < .80$ .

**Conclusions:** Results of this study indicated a decrease in incidence of NSS for only one of the five tasks examined, graphesthesia, with increasing age. Rigor in psychometric testing parameters most likely contributed to the attainment of good to excellent interrater reliability. Implications for assessing NSS across age and adhering to psychometrically rigorous methodology in the assessment of NSS are highlighted.

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**J.C. SCHNEIDER, R. TAMAROFF, P. ISQUITH & G. GIOIA. Assessment of Emotional Functioning in Children with Concussion: Initial Development of a Parent and Child Measure of Mood State.**

**Objective:** Changes in emotional states following concussion are poorly understood in young children. To that end, we developed a child and informant (parent) mood questionnaire (Child Mood Checklist [CMC]) to facilitate measuring mood changes following concussion.

**Participants and Methods:** We developed a child-oriented mood state questionnaire following the well-established adjective checklist model. The measure asks children and/or their parents to respond to 30 adjectives describing current mood. 158 typically developing children (mean age=8.77 years, 65% male) and their parents participated as the control group. 39 children with concussion (mean age=9.47 years, 75% male) and their parents constituted the clinical group.

**Results:** The CMC demonstrated good internal consistency within the control group (child  $\alpha=0.83$ , parent  $\alpha=0.83$ ). There were no significant age-related differences in ratings (child  $p=0.74$ , parent  $p=0.53$ ). Although significantly different from each other ( $p<0.001$ ), typically developing children and their parents reported relatively low mood disturbance overall (Total Mood Dysfunction: child mean=-1.60,  $sd=5.79$ , parent mean=-3.88,  $sd=4.84$ ). Typically developing children and their parents reported significantly fewer mood concerns than did children with concussion ( $p<.01$ ) and their parents ( $p<.05$ ) on retrospective baseline. Children with concussion and their parents also reported significantly greater mood disturbance immediately post-injury compared to their retrospective pre-injury ratings (child report  $F=4.95$ ,  $p<.001$ , parent report  $p<.001$ ).

**Conclusions:** Despite the presence of significant and sometimes enduring emotional symptoms in adults with concussions, emotional changes in children following concussion are poorly understood. To that end, the present study introduced a new measure of state emotional functioning for young children to facilitate measuring mood concerns.

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**A.R. SLONAKER, W.M. MUCHERAH & W.H. FINCH. School Psychologists' Training in Neuropsychological Assessment.**

**Objective:** Neuropsychological assessment can provide a wealth of information pertaining to a student's specific strengths and weaknesses as well as measure a variety of functions and behaviors, such as memory, language, motor and sensory abilities, and cognition. A review of literature has established a rationale for utilizing neuropsychological assessment, particularly in the school setting. Yet, studies have shown that many school psychologists typically have not been adequately trained in neuropsychology. The purpose of this study was to gain current information regarding school psychologists' training specific to neuropsychology.

**Participants and Methods:** A questionnaire was developed by the researcher to acquire current information regarding school psychologists' neuropsychological training. The questionnaire was randomly distributed to members of the National Association of School Psychologists (NASP) who were practicing in public school settings across the United States. 205 participants responded to the questionnaire.

**Results:** Data was analyzed using descriptive analysis. The majority of respondents indicated their confidence level in adequately using neuropsychological assessment in the schools to be "minimally confident" (40%) to "not at all confident" (30%). Those who had training in neuropsychology indicated such training was primarily through workshop presentations or in-service training (71%) or formal course work in their training program (50%). However, 82% of respondents indicated a desire for more training in neuropsychology.

**Conclusions:** Results suggest a need for additional training of school psychologists in neuropsychology and its application in the school setting. These findings are consistent with previous research with regard to school psychologists' training in neuropsychology.

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**L.D. BERKELHAMMER, A.R. STUDAWAY & J.S. BERMAN. A meta-analysis of neurocognitive and achievement outcomes in pediatric sickle cell disease.**

**Objective:** We sought to determine the severity of neuropsychological and achievement deficits in children with SCD compared to non-SCD peers. We also sought to test six common assumptions: 1) children with SCD perform worse than those without SCD across outcome measures; 2) degree of neurological insult affects performance; 3) genotype effects outcomes, 4) age effects outcomes 5) SES lacks relevance, and 6) children with SCD have a higher rate of special education services. Methodological factors were examined.

**Participants and Methods:** PubMed, Psychlit, and Medline searches were conducted using the terms sickle cell and neurocognitive, neuropsychology, IQ, achievement, academic, memory, language, motor, and visual-spatial. Inclusion criteria were: mean age <18 years; at least one comparison group; and, X, SD, and N of each group on each outcome measure was reported or obtained. 56 articles were found; a subset (N=16) employing non-SCD controls was analyzed.

**Results:** Comparison controls were mostly siblings (63.5%) and healthy peers (23.7%). Mean age was 11.3 years. Non-SCD outperformed SCD on global cognitive ability ( $p=.000$ ), achievement ( $p=.002$ ), memory ( $p=.000$ ), and language ( $p=.006$ ). Reading scores differed significantly by control group. Mean age was associated with language outcomes ( $p=.003$ ) with group differences increasing by age. SES estimates differed significantly between SCD and controls; main effects were found for Hollingshead but not income alone. Special education services were more prevalent in SCD over non-SCD (73.7% v. 26.2%) but did not impact outcomes. Inclusion of HbSC genotype did not significantly impact D.



**Conclusions:** Assumptions 1, 2, 4, and 6 were supported but not 3 and 5. Findings suggest the importance of SES. Aggregated data partially corrects for methodological constraints in the primary studies that may have contributed to previously reported, mixed findings. This meta-analysis provides a more definitive assessment of the SCD neurocognitive literature.

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**M.D. SWARTWOUT, K.A. O'BRIEN, K.D. EVANKOVICH & M.L. CHAPIESKI. Development of a Child Memory Questionnaire for Parents and its Relation to Neuropsychological Performance.**

**Objective:** In adults, memory performance is often modestly correlated with self- and other-reports. In children, the relationship is largely unknown due to lack of reliable, valid memory questionnaires. In the present study, we evaluated a pilot version of a child memory questionnaire for its factor structure and its relationship to cognitive measures.

**Participants and Methods:** Participants included 170 children referred to a neurology clinic (ages 8-18) and their parents. Parents completed the memory questionnaire, and children underwent neuropsychological testing. We conducted exploratory factor analysis (EFA) to determine the underlying factor structure. Correlations between obtained factors and test data were calculated. We used stepwise regression to predict academic skill from memory questionnaire and test scores.

**Results:** EFA identified two factors: "Learning" (11 items,  $\alpha = .88$ ) assessed the child's ability to learn and retain information; "Prospective Memory" (10 items,  $\alpha = .87$ ) assessed the capacity to remember to complete tasks. The factors were related but distinct ( $r = .40$ ). Only the Learning factor was significantly correlated with verbal memory test performance and IQ. Neither was correlated with age, maternal education or continuous performance test performance. Both factors were better predictors of math and reading skills than was performance on memory tests.

**Conclusions:** This pilot memory questionnaire assesses both learning and prospective memory in children with adequate internal consistency. The two aspects of reported memory were differentially associated with actual memory test performance but both were good predictors of academic skill and performance. These results indicate that further scale development is warranted, including item refinement and further validation.

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**V.J. TSAMIS. An Examination of the Sustained Attention Measures Postulated by the Mirsky's Attention Model for Use in Childhood.**

**Objective:** A well-recognized dimension of attention is sustained attention. When the Continuous Performance Test was introduced as a measure of attention, emphasis was placed on the number of correct hits as an indicator of attention (Rosvold et al., 1956). Since then, the number of indices of attention has increased to include omission errors (misses), commission errors (incorrect responses) and reaction time. The CPT necessitates a five-minute concentration period during which participants respond to visual stimulus targets (letter X) that appear in a pseudorandom sequence with a probability of .20 each on a computer screen by pressing the space bar. A total of 300 letters are presented with a 100 millisecond stimulus duration and a 900 millisecond interstimulus interval. The current study examined the sustained attention measures presented in Mirsky's attention model.

**Participants and Methods:** The current sample was drawn from a study entitled, "Development and Malleability from Childhood through Adulthood Mental Health Study". The same neuropsychological measures reported to assess the various dimensions of attention gleaned from a sub-sample of second graders ( $n=335$ ) of the original attention sample were first submitted to Exploratory Factor Analysis.

**Results:** All of the CPT measures presented by Mirsky et al. to assess sustained attention loaded on a single factor with loadings ranging from .44 to .90. These CPT measures were then submitted to Pearson product moment correlation analyses. While the CPT measures were correlated, the strong positive relationship between the number of correct responses and the number of omission errors ( $r=.92, p=.000$ ) was especially noteworthy. As a result, the CPT measures were standardized and submitted to reliability analysis which then resulted in a Cronbach's  $\alpha = .78$ , above the acceptable standard of .70.

**Conclusions:** Results are discussed within the context of using Mirsky's et al. attention model to assess sustained attention in childhood.

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## Autism Spectrum Disorders

**S.A. ANDERSON & D.L. ROBINS. Differentiation of Autism Spectrum Disorders from other Developmental Delays: M-CHAT Plus a Measure of Initiation of Joint Attention.**

**Objective:** The American Academy of Pediatrics recommends autism specific screening at well-child visits. Differentiating autism spectrum disorders (ASD) from language or global developmental delay (DD) is challenging due to symptom overlap. The M-CHAT screen identifies children at risk for ASD. However, the M-CHAT also flags children with DD. Studies show that children with ASD show more impairment in initiation of joint attention (IJA) than children with DD. The ESCS measures social communication skills and includes a domain specific to IJA. The current study examines whether the combination of M-CHAT and ESCS IJA scores predict ASD vs. DD diagnosis more accurately than M-CHAT scores alone.

**Participants and Methods:** DD ( $n=8$ ) and ASD ( $n=18$ ) participants were recruited from a larger study. Parents of participants completed the M-CHAT at well-child checkups. Those identified as at risk for developmental delay completed the ESCS and a diagnostic evaluation.

**Results:** Binary logistic regression analyses were conducted. A model with IJA and M-CHAT critical item scores classified participants as either ASD or DD significantly better than M-CHAT scores alone,  $\chi^2(2)=19.244, p=.000$ . IJA was a significant independent predictor of diagnostic group membership,  $\beta=-.573, SE=.253, p=.024$ . When cognitive development level was controlled, the IJA and MCHAT model remained significant,  $\chi^2(3)=23.768, p=.000$ . IJA remained a significant independent predictor,  $\beta=-.634, SE=.320, p=.048$ . Similar results were found using M-CHAT total scores.

**Conclusions:** Findings suggest that addition of an observational measure of IJA to M-CHAT screening improves differential diagnosis. Clinicians may use these measures to tailor ASD referrals.

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**L.N. BERRY, D. TREADWELL-DEERING, M.P. POWELL, T.M. LYLE-LAHROUD, L.M. NOLL, K.B. ADKINS & M.C. GIBBS. Parenting Stress in Caregivers of Children with Autism Spectrum Disorders.**

**Objective:** Elevated levels of parenting stress have been well-documented in parents of children with Autism Spectrum Disorders (ASDs). The purpose of this study was to explore relationships between parenting stress and child characteristics including ASD symptomatology and adaptive functioning.

**Participants and Methods:** Participants included 38 children clinically referred for suspected ASD (mean age=52.7 months). The Parenting Stress Index (PSI), Vineland Adaptive Behavior Scales, Second

Edition (VABS), Autism Diagnostic Interview, Revised (ADI-R), and Autism Diagnostic Observation Schedule (ADOS; Module 1 or 2) were administered. Participants were diagnosed with Autistic Disorder ( $n=35$ ), Asperger's Disorder ( $n=1$ ), and PDD-NOS ( $n=2$ ). Associations between PSI, VABS, ADOS, and ADI-R scores were examined.

**Results:** Nearly one-third of caregivers ( $n=12$ ) reported clinically significant levels of parenting stress. A positive correlation was observed between overall parenting stress and child age ( $p=.02$ ). Adaptive functioning deficits were also associated with elevated parenting stress (all  $p$ -values  $<.05$ ), as well as higher scores in the Child Domain. Parent report of ASD symptomatology was associated with higher scores on Child Domain subscales. ADOS scores were not correlated with parenting stress, with the exception of a positive association between impairments in the area of play/imagination/creativity and scores on the Distractibility/Hyperactivity subscale of the PSI.

**Conclusions:** Parent report of child adaptive functioning impairments and ASD symptomatology was more often associated with higher levels of parenting stress than was clinical observation of ASD symptoms and behaviors. This study supports the extant literature indicating high rates of stress related to parenting children with ASD and highlights specific child characteristics (i.e., functional impairments) associated with parenting stress.

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#### L. BRUBAKER, S.E. CHRIST & J. MILES. Evidence for Selective Inhibitory Impairment in Individuals with Autism Spectrum Disorder.

**Objective:** Executive dysfunction is considered a central deficit among individuals with autism spectrum disorder (ASD); however, findings have been inconsistent regarding the degree to which individuals with ASD experience impairment in inhibitory control (IC). Work by Friedman and Miyake (2004) suggests that IC may comprise at least three distinct subtypes: prepotent response inhibition, resistance to distracter interference, and resistance to proactive interference. Whereas previous studies have focused on only one or two of these subtypes when evaluating the integrity of IC in individuals with ASD, the present study is the first to assess all three aspects of IC within a single ASD sample.

**Participants and Methods:** Thirty-Seven individuals with ASD (mean age = 15.1 years) and thirty-six typically developing individuals (mean age = 13.6 years) participated in the study. Prepotent response inhibition, resistance to distracter interference, and resistance to proactive interference were measured using a counting Stroop task, a flanker visual filtering task, and a modified Brown-Peterson task, respectively.

**Results:** The groups performed comparably on the Stroop and Brown-Peterson tasks ( $p > .05$  in all instances), suggesting that prepotent response inhibition and resistance to proactive interference are relatively intact in individuals with ASD. In contrast, the ASD group performed more poorly than the control group on the flanker task [ $F(1, 72) = 7.464$ ,  $p < .05$ ], indicating impairment in the ability to inhibit distracting visual information.

**Conclusions:** The results support the hypotheses that dissociable subtypes of IC exist and that ASD is associated with impairments in some, but not all, aspects of IC.

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#### D. CANTOR, M. MALONE & R. CHABOT. QEEG and VARETA Profiles in Autism Spectrum Disorders: Severity and Medication Correlates.

**Objective:** Brain functional descriptors were sought that can be used to define autism spectrum populations.

**Participants and Methods:** EEG using a 19 site monopolar montage was collected on 36 individuals ranging in age from 5 to 35 years with Autism Spectrum Disorder defined by DSM-IV criteria and measures of autism characteristics. Delta, theta, alpha, and beta frequency bands

with derived univariate and multivariate measures for power and asymmetry measures were then converted to z-scores relative to a database of age-matched normals. ANOVAs were used to compare autistics who had been previously medicated versus those who were never medicated and for analyzing groups differing on severity of autistic symptoms as defined by measures of autism such tools as C.A.R.S.

**Results:** Autistics were noted to have a number of differences from normal principally in the anterior regions. There are significant differences from normal QEEG measures between ASD patients that are medicated versus never medicated. Results indicate that medication influences coherence and asymmetry measures in central regions and anterior delta relative power. It was noted that with increasing severity of ASD the following was noted: decreasing anterior and central absolute and relative power beta; increasing mean beta in anterior regions; increasing posterior alpha in right hemisphere; increasing interhemispheric asymmetries in the anterior regions in theta and alpha; and increasing intrahemispheric left frontal coherence.

**Conclusions:** These results reveal confounds in autism brain function research with regard to severity of symptoms and possible residual medication effects. Source localization implicates the cerebellum, thalamus, anterior cingulate, and frontal and temporal regions of the cortex. Medication versus non-medication appears to predominantly indicate the left superior temporal region.

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#### A.S. CHAN, M. CHEUNG, Y.M. HAN, L. SZE & W.W. LEUNG. Executive Function Deficits and Neural Discordance in Children with Autism Spectrum Disorders.

**Objective:** Individuals with Autism Spectrum Disorders (ASD) exhibit structural and neurophysiologic frontal lobes abnormalities, and executive dysfunctions. This study examined the neurophysiologic activities, executive dysfunctions, and their association in children with ASD.

**Participants and Methods:** Thirty-eight normal children (NC) and 16 children with ASD participated with their executive functions measured using neuropsychological tests and parent ratings. And their neurophysiologic activities were measured using EEG to yield cordance values, an indirect measure of brain perfusion.

**Results:** In executive functions, children with ASD made significantly more intrusion errors and recognition false alarms on the Hong Kong List Learning Test (HKLLT) and Object Recognition Test (OR) than NC, but were comparable to NC on the Rey-Osterrieth Complex Figure Test and Continuous Performance Test. Results on the Behavior Rating Inventory of Executive Function (BRIEF) also showed significantly poorer executive functions of children with ASD in everyday activities. Neurophysiologic measurements suggested that children with ASD had lower frontal perfusion patterns than NC as shown in the cordance measures. Frontal cordance values were also found to be significantly associated with executive dysfunctions in HKLLT delayed intrusion, OR false alarm and BRIEF.

**Conclusions:** Children with ASD demonstrated impairment in everyday executive functioning as shown in the BRIEF, and in response inhibition as shown in their impaired intrusion and false alarm scores on the HKLLT and OR. The cordance value, as an indirect measure of brain perfusion, was also significantly correlated with executive dysfunctions. Further studies to explore the use of this measure, for example, as an index for response to intervention is warranted.

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#### N. CRUZ & C. GIBBS. Flexibility and Adaptive Functioning in Children with Autism Spectrum Disorders.

**Objective:** Inflexibility has been associated with the neurobehavioral profile of children with Autism Spectrum Disorders (ASD). Research

also identifies adaptive functioning deficits in this population. Little research has evaluated the relationship between flexibility and adaptive functioning in this population. Moreover, few studies measure everyday flexibility behaviors. This study explores the relationship between flexibility and adaptive functioning among children with ASD, using both performance-based and ratings-based measures of flexibility.

**Participants and Methods:** Participants included 26 clinically-referred children (ages 6-16) diagnosed with ASD (Higher Functioning Autism=8; Asperger's Disorder =10; Pervasive Developmental Delay, Not Otherwise Specified=8) who completed the Creature Counting subtest of the Test of Everyday Attention for Children, Shift domain on the Parent form of the Behavior Rating Inventory of Executive Function (BRIEF), and Parent form of the Adaptive Behavior Assessment System- Second Edition (ABAS-II). Bivariate correlations and regression were conducted to examine the hypotheses.

**Results:** Bivariate correlations indicated lower performance-based flexibility on the Creature Counting subtest was associated with lower General Adaptive, Conceptual and Social Composite scores (ABAS-II). Likewise, lower parent-rated flexibility (BRIEF) was associated with lower scores on the same composites. Following regression analyses, lower parent-rated flexibility continued to predict lower Conceptual and Social Composite scores. However, performance-based flexibility did not remain a significant predictor of adaptive functioning above and beyond parent-rated flexibility.

**Conclusions:** Findings reflect how flexibility is an important component of the neurobehavioral profile of children with ASD and relates to the adaptive functioning weaknesses commonly reported. Future research is required to clarify this relationship.

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#### S. FILERMAN, M. STEPANSKY, B. VELISEK, K. O'BRIEN, J. DORFLINGER & A. DAVIS. **BASC-2 Profiles for Children Diagnosed with Autism, Asperger's Disorder, and Pervasive Developmental Disorder-Not Otherwise Specified.**

**Objective:** The current study explored the pattern of parent ratings on Behavior Assessment System for Children 2nd Edition (BASC-2) in children diagnosed with Autism, Asperger's Disorder, and Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS).

**Participants and Methods:** Participants were 104 children between the ages of 2-18, who received an extensive diagnostic assessment at a medical center including administration of the Autism Diagnostic Observation Schedule. The BASC-2 responses from each child's mother were used to compare the level of functioning across the diagnostic groups. Analyses of variance (ANOVA) were used to compare patterns of group performances.

**Results:** The profiles of the three groups followed a similar pattern across clinical scales. Specifically, all groups displayed the expected "high-point pair" (e.g., Reynolds & Kamphaus, 2002) of Atypicality and Withdrawal ( $p < .01$ ), but the Asperger's group had an additional elevation for Depression relative to the other groups ( $p < .05$ ). However, there was a significant diagnosis by BASC-2 clinical scale interaction such that, children with Asperger's were rated to have high levels of Internalizing Problems ( $p < .05$ ) and children with Autism were rated to have low Adaptive Skills ( $p < .01$ ). Additionally, within the Adaptive Composite, children with Asperger's were rated to have difficulty adapting to change (Adaptability;  $p < .01$ ), and children with Autism were rated to have low Functional Communication ( $p < .01$ ).

**Conclusions:** Profiles based on BASC-2 parent ratings were consistent with existing literature regarding the patterns of scale elevations. The current data extended previous research by differentiating the patterns of parent ratings for DSM-IV based diagnoses of Autism, Asperger's Disorder, or PDD-NOS. Understanding these differences has implications for behavioral interventions and educational planning.

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#### C. GIBBS, P. POWELL, T. LYLE-LAHOUD, L. NOLL & A. CHI. **A Neuropsychological Model for Parent Reported Sensory Abnormalities in Children with Autism.**

**Objective:** Sensory abnormalities are commonly reported in children with Autism Spectrum Disorders (ASD) and are identified as critical targets for treatment despite the fact that the symptoms and underlying causal mechanisms are poorly defined. The purpose of this study was to provide an explanation for parent reported sensory abnormalities in children with ASD using a neuropsychological model based on the executive control of behavior.

**Participants and Methods:** Parents of clinically referred children with ASD ( $n=22$ ; mean age= $7\pm 1.7$ ; 19 male; Non-verbal IQ= $90\pm 23.6$ ) completed the Behavior Rating Inventory of Executive Function (BRIEF) and the Short Sensory Profile.

**Results:** Moderate correlations were found between the Total Score of the Short Sensory Profile and the BRIEF Metacognition Index ( $r = -.624$ ,  $p = .002$ ) and Behavioral Regulation Index ( $r = -.742$ ,  $p = .000$ ). Using stepwise multiple regression analysis the BRIEF Behavioral Regulation Index accounted for over half the variance in the Short Sensory Profile Total Score ( $R^2 = .550$ ,  $p = .000$ ) while the BRIEF Metacognition Index did not significantly contribute to the model (partial  $r = -.028$ ,  $p = .903$ ).

**Conclusions:** Findings indicate that in this sample of children with ASD the BRIEF Behavioral Regulation Index accounted for over half the variance in the Short Sensory Profile Total Score. These findings support the hypothesis that parent reported sensory abnormalities in children with ASD may be better explained by the executive control deficits that are already well described in the population as opposed to a sensory integration disorder hypothesis for which there is little empirical support. Correspondence: *Cullen Gibbs, Ph.D., Learning Support Center, Texas Children's Hospital, 6621 Fannin Street, CC1630.30, Houston, TX 77030. E-mail: gibbs@bcm.edu*

#### C.H. KANG, L.K. PAUL, F. CASTELLI & W.S. BROWN. **Theory of Mind in Agensis of the Corpus Callosum versus High Functioning Autism.**

**Objective:** The nature of social deficits in agensis of the corpus callosum (ACC) is still unclear, but appears to involve impaired theory of mind (ToM), a deficit also seen in autism. ToM performance in adults with ACC was compared to that of controls and high functioning adults with autism (HFA) using the Castelli Animation Test.

**Participants and Methods:** The animation test was administered to 7 adults with ACC (ages 19-38, VIQ 81-115, PIQ 86-135), and to 10 age- and IQ-matched participants with HFA and 12 matched controls. Castelli's three types of animations involve triangles that either move randomly, or interact in a goal-directed or mentally-motivated manner (reflecting ToM). Participants' verbal descriptions of the animations were scored for inferred intentionality, appropriateness relative to typical interpretations, and length.

**Results:** Significant group differences were found for the mentally-motivated (ToM) animations. Responses of the ACC group were less appropriate ( $p < .01$ ) and inferred less intentionality ( $p < .05$ ) than controls. However, relative to participants with HFA, the ACC group inferred significantly more intentionality than the autism group ( $p < .05$ ) but was not different in appropriateness of their responses.

**Conclusions:** Both the ACC and HFA groups exhibited impaired interpretation (inference of intentionality and appropriateness) of mentally-motivated animations relative to controls. However, while similar in the appropriateness of their responses, the ACC group was more likely than the HFA group to infer intentionality. Thus, individuals with ACC share deficits in social inference with individuals with HFA, but the deficit is less severe. Correspondence: *Warren S. Brown, Ph.D., Travis Research Institute, Fuller Grad Sch of Psych, 180 N. Oakland Ave., Pasadena, CA 91101. E-mail: wsbrown@fuller.edu*

#### S. MOSTOFSKY. **Contributions of Postural Knowledge and Basic Motor Skill to Dyspraxia In Autism: Suggestion of Abnormalities in Distributed Connectivity and Motor Learning.**

**Objective:** Children with autism often have difficulty performing skilled gestures. This "dyspraxia" is significant after accounting for basic mo-

tor deficits. Performance of skilled gestures requires knowledge of spatial and temporal representations of the movement, mediated by parietal regions, and transcoding of these representations into movement plans, mediated by premotor regions. The goals of this study were: (1) to determine whether autism is associated with impaired representational knowledge of skilled gestures (“postural knowledge” or “PK”) and (2) to examine the combined contributions of PK and basic motor skill to dyspraxia in autism.

**Participants and Methods:** 34 children with HFA and 37 typically-developing (TD) children, ages 8-13, completed: (1) the postural knowledge test (PKT), a praxis discrimination test assessing knowledge of transitive/intransitive postures (2) a childhood examination of basic motor skills (PANESS), and (3) a praxis examination including gestures to command, imitation, and tool-use.

**Results:** Children with HFA showed worse PK than TD controls ( $F=5.350$ ,  $p=.02$ ). Hierarchical regression further revealed that, after controlling for age and IQ, both basic motor skill ( $\Delta R^2=.11$ ,  $p=.004$ ) and PK ( $\Delta R^2=0.16$ ,  $p<0.0001$ ) were significant predictors of praxis performance; still, the HFA group continued to show significantly poorer praxis than controls after accounting for these abilities ( $\Delta R^2=0.19$ ,  $p<0.0001$ ).

**Conclusions:** The findings suggest that dyspraxia in autism is associated with both impaired formation of spatial representation as well as transcoding and execution of skilled movements. This would be consistent with a model in which distributed abnormality across parietal, premotor and motor circuitry, and/or connectivity between these regions, contributes to dyspraxia in autism. The findings might also be explained by a developmental model in which impaired acquisition leads to anomalous formation of both spatial and motor representations of skilled movements, as well as impaired execution.

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**J. NIELSEN, N. LANGE, A. ALEXANDER, J. LEE, M. DUBRAY, A. FROELICH, E. BIGLER & J. LAINHART. Subtypes of Autism Based on Corpus Callosum Microstructure: A Diffusion Tensor Imaging and Neuropsychological Study.**

**Objective:** We observed evidence of autism subgroups based on white matter microstructure of the total corpus callosum (CC) using diffusion tensor imaging (DTI) (Alexander et al 2007). The purpose of this new study was to further determine how the autism subgroups differed from each other and from typical controls. We hypothesized that the abnormal subgroup would show uniform abnormalities in radial diffusivity ( $D_r$ ) in three callosal subregions (genu, midbody, and splenium) and that these abnormalities would be related to differences in measures of IQ and language.

**Participants and Methods:** We compared 3 Tesla DTI data and neuropsychological data from the autism subgroup with abnormally low total CC fractional anisotropy (FA) and high mean diffusivity ( $n=12$ ) to the other autism group ( $n=12$ ) and to typical controls ( $n=12$ ). The three groups were closely matched on age, sex, IQ, handedness, and head circumference.

**Results:** The abnormal autism subgroup manifested abnormally high  $D_r$  and low FA across the total corpus callosum as well as in three callosal subregions—genu, body, and splenium. Full Scale IQ correlated significantly with the FA of the genu and splenium and verbal memory correlated significantly with the FA of the splenium when the three groups were combined. When examining CC DTI-neuropsychological relationships *within* groups, the relationship between CC microstructure and neuropsychological function was different in the autism subgroups in an unexpected way: the structure-function relationship in the DTI-abnormal autism group was similar to typically developing controls; the DTI-“normal” group differed from both of these groups.

**Conclusions:** White matter microstructure of the CC appears to identify unique subgroups of autism subgroups that have different relationships between brain structure and function.

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**K. BAXTER, C.A. NOGGLE, L. CHAPMAN, C. SADLER & R.S. DEAN. Cortical and Subcortical Sensory-Motor Profiles in Pervasive Developmental Disorder NOS.**

**Objective:** Empirical evidence has demonstrated that motor deficits may often present in presentations that fall under the heading of Pervasive Developmental Disorders. While this is established in the more defined presentations such as Autism and Asperger’s, little investigation has been offered into the presence of such dysfunction in those individuals classified as having signs and symptoms of a Pervasive Development Disorder-Not Otherwise Specified. The current study investigated whether sensory and/or motor deficits appeared to present in a sample of individuals diagnosed with PDD-NOS.

**Participants and Methods:** An archival data asset was utilized for the present study. Participants included 25 children and adolescents diagnosed with a Pervasive Developmental Disorders NOS and 40 children and adolescents not diagnosed with any neurological or psychological presentation. All participants were administered the Dean-Woodcock Sensory-Motor Battery as part of a full neuropsychological assessment.

**Results:** Multivariate analysis revealed individuals diagnosed with PDD-NOS demonstrated significantly impaired performance across a wide variety of sensory and motor domains. These deficits were noted in palm writing and object identification with both hands, gait and station, Romberg, cross construction and clock construction, mime movements, left-right movements, and finger tapping with both dominant and non-dominant hands.

**Conclusions:** Findings demonstrate a specific link between the presentation of sensory and motor deficits in PDD-NOS. While these individuals may fail to meet the diagnostic criteria for more specific presentations along this spectrum, they tend to exhibit subtle yet similar dysfunctions. Current results demonstrate this holds true for motor deficits as well. Additional findings and implications will be offered.

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**G. PYO, K. CURTIS & R. CURTIS. Orientation Functioning of Individuals with Moderate to Severe Intellectual Disability.**

**Objective:** Orientation is an indication of general cognitive functioning and an important part of mental status examination. However, studies of direct assessment of orientation of individuals with ID are scarce, especially among adults with moderate to severe ID.

**Participants and Methods:** 42 healthy adults with moderate to severe ID (age  $50.6\pm 6.8$ ; IQ  $35.1\pm 12.2$ ; age-equivalent functional level  $6.1\pm 1.7$ ) were examined for their orientation functions. Their names, dates of birth, ages, the locations of the group homes (the test was administered at their group homes), the current date, month, and year were asked as recommended by The Working Group for the Establishment of Criteria for the Diagnosis of DAT in Individuals with ID under the auspices of the International Association for the Scientific Study of Intellectual Disability and the American Association on Mental Retardation.

**Results:** All participants were able to say their names. 73% knew their birthdays, 48% knew the years they were born, and only 33% knew their ages. The majority knew where they lived (65% for the state, 78% for the city, and 80% for the name of the group home), the current week (80%) and the month (68%). However, only 38% knew the current date. The participants whose functioning levels were lower than 4 years old could not answer the majority of those questions except their names.

**Conclusions:** The results indicated that even non-demented adults with moderate to severe ID displayed significant impairment in orientation, and functional level appeared to be a more important factor than IQ or age.

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**M. STEPANSKY, S. FILERMAN, K. O'BRIEN, B. VELISEK, J. DORFLINGER & A. DAVIS. WISC-IV Profiles of Children with Autism Spectrum Disorders.**

**Objective:** The current study explored the Wechsler Intelligence Scale for Children - 4th Edition (WISC-IV) profiles and verbal-nonverbal split of children diagnosed with Autism, Asperger's Syndrome, and Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS).

**Participants and Methods:** Participants were 45 children between the ages of 7-16, who received an extensive diagnostic assessment at a medical center including administration of the Autism Diagnostic Observation Schedule (ADOS). Profile analyses (see Dickerson Mayes & Calhoun, 2004) of WISC-IV included ranking of subtests from highest to lowest and using descriptive statistics to compare group performances.

**Results:** Comprehension was the lowest score within the Verbal Comprehension Index (VCI) for all three groups. Additionally, the three groups showed an overall relative weakness for Coding and an overall relative strength for Block Design. Interestingly, Similarities was an overall relative strength for all three groups. While children with autism showed the expected verbal-nonverbal split favoring nonverbal abilities, children with Asperger's Syndrome and PDD-NOS did not show a verbal-nonverbal split. Additionally, results showed higher Full-Scale IQ scores for children with Asperger's Syndrome in comparison to children with autism,  $F(1,41) = 6.029, p < .01$ , but not to children with PDD-NOS.

**Conclusions:** Profiles based on subtest scores were similar for children across the autism spectrum disorders; however, overall cognitive profiles differed based on their specific diagnoses. These similarities and differences have implications for educational accommodations and behavioral interventions.

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**L.L. THEDE & J. ORAKER. Diagnostic and Treatment Needs of the Autistic Community: A Survey of Parents and Adults on the Spectrum.**

**Objective:** Despite increasing evidence that autism spectrum disorders are a lifelong neurodevelopmental condition which occur with relative frequency, diagnostic services and treatment methodologies continue to focus on children. The purpose of this survey was to identify the needs of families with an autistic member as perceived by parents of children on the spectrum, as well as adults on the spectrum.

**Participants and Methods:** Families with an autistic member were invited to complete a survey of the types of diagnostic and treatment services they have already acquired, as well as services for which they have been unable to acquire. Both qualitative and quantitative data were collected, summarized, and analyzed with respect to various general categories such as early intervention, financial resources, adult services, and parent support.

**Results:** Preliminary results reveal that family members of autistic individuals are seeking a significant number of services beyond behavior modification and social skills development. Especially noteworthy are concerns regarding help in gaining and maintaining employment, career selection, and determination of legal capacity for managing finances and living independently, as well as making future provisions for adult dependents who continue to rely heavily on the support of their aging parents.

**Conclusions:** Accurate and reliable means of diagnosing an autism spectrum disorder in high-functioning adults is becoming increasingly sought after, as well as a variety of services to assist these adults in occupational functioning, interpersonal relationships, managing depression and anxiety, and developing independent living skills or obtaining support in areas where skills are lacking. As such, service providers ought to consider the developmental needs of high-functioning adult individuals on the spectrum who continue to need supportive living services not easily accessible and in short supply.

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**Learning Disabilities/Academic Skills**

**P.J. CARVAJAL, L.J. ALTMANN & L.J. LOMBARDINO. Information Recall in Compensated Adult Dyslexics: Does Repetition Help?**

**Objective:** Underlying phonological deficits in adults with developmental dyslexia (DD) may impair their ability to encode and recall auditory information. This study examined auditory passage recall in compensated adults with DD when responses were written or oral. We predicted the DD group would recall less in the written modality and that their initial deficits in recall would diminish after hearing the passage twice.

**Participants and Methods:** 19 individuals with DD and 23 normal readers (NR) enrolled in college participated in the study. The researcher read a paragraph to the participant who repeated it first in writing then orally after hearing the paragraph a second time. Order of response modality was counterbalanced across participants. The dependent variable was the amount of information recalled in each response. Participants also completed orthographic and auditory N-back tests to measure working memory, and Digit Symbol Copying, Trails A and B, and Stroop tests to measure executive function and processing speed.

**Results:** The DD group performed more poorly than NRs on written recall regardless of task order. Although NRs outperformed the DD group overall, the two groups did not differ significantly on the first retelling, but at the second retelling the DD group recalled significantly less information than NRs. Amount of information recalled at the second retelling was predicted by processing speed/executive function not working memory.

**Conclusions:** Deficits in processing speed and executive function may interfere with the encoding and recall of auditory information in DD, even when information is repeated. Recall is further limited if the response is written. This information bottleneck is apparent even in highly compensated adults with dyslexia.

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**R. WISEHEART, L.J. ALTMANN & D. MAGDALES. Rime Neighborhood Density Effects on Rapid Automated Naming (RAN).**

**Objective:** Dyslexia is characterized by deficits in constructing and using phonological representations. While individuals with dyslexia frequently perform poorly on RAN, the phonological aspects of RAN have not been addressed in the literature. Rime neighborhood density is hypothesized to influence quality of phonological representations, with words from sparse neighborhoods less robustly represented. If so, stimuli from sparse neighborhoods should slow RAN performance in normal readers.

**Participants and Methods:** 20 adults, ages 18-42 completed 4 RAN tasks, each comprising 5 monosyllabic words represented by line drawings. Stimulus sets within each RAN task were comparable for frequency but differed in rime neighborhood density. Two stimulus sets represented sparse neighborhoods ( $M = 5.2$ ), and 2 stimulus sets represented dense neighborhoods ( $M = 34.5$ ). Each participant completed sparse and dense rime neighborhood RANs in 2 presentation conditions: a traditional offline form and an online form. In the offline task, stimuli were presented in a traditional RAN matrix format, with 5 rows of 8 items per page. In the online version, stimuli were presented one at a time on a computer screen in random order.

**Results:** In online and offline conditions, naming times for words from dense neighborhoods were significantly faster than naming times for words from sparse neighborhoods (Offline:  $F(1,19) = 16.5, p = 0.001$ ; Online:  $F(1,18) = 13.7, p < 0.01$ ).

**Conclusions:** Results from this study indicate that, among healthy adults, RAN performance is highly influenced by neighborhood density of stimuli, reflecting perhaps representational adequacy. We propose that, in dyslexia, slow RAN performance reflects the weak phonological representations inherent to the disorder, thus, nearly any stimulus set would seem to come from a sparse neighborhood.

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**R. BRAHMACHARI, M.Y. KIBBY & G.W. HYND. Insula Volume in Relation to Dyslexia: A Structural MRI Study.**

**Objective:** Individuals with dyslexia frequently present with internalizing problems, and the insula has been implicated in both dyslexia and physiological aspects of anxiety in separate studies. As prior research has not examined the relationship between insula volume, anxiety, and dyslexia, this was the goal of our study.

**Participants and Methods:** Participants were obtained from a larger study on dyslexia and AD/HD (NIH R01 HD26890). Data analysis and write-up were partially supported by another grant (NIH R03 HD048752). Forty-seven children, ages 8 to 12 years, completed a neuropsychological battery and a MRI scan: 13 had dyslexia, 11 had comorbid dyslexia and AD/HD, 14 had AD/HD, and 9 were controls. The insula was traced in the sagittal plane following the guidelines of Wible et al. (1997). Inter- and intra-rater reliability were > 0.90.

**Results:** A 2 (dyslexia or not) × 2 (AD/HD or not) MANCOVA was conducted to compare groups on insula volume, controlling for cerebral hemisphere volume. No group differences were found in insula volume. Hence, the relationship between insula volume, reading ability and anxiety was examined in the total sample using Pearson correlation. No significant correlations were found between insula volume and reading ability. In contrast, left posterior insula volume was moderately correlated with RCMA Total Anxiety, and left anterior insula volume had a modest relationship with RCMA Physiological Anxiety and BASC-PRS Somatization.

**Conclusions:** Although we did not find a relationship between insula volume and reading ability, future research on the insula in relation to anxiety is warranted.

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**M. CONSTANTINOU. Neuropsychological Evidence that Special Education Works.**

**Objective:** The current study investigated the neuropsychological benefits gained by 12 months of special education in elementary school children.

**Participants and Methods:** Among a large number of children, sixty-two elementary school children, identified with learning disabilities, between the ages of six and seven (first graders) were initially evaluated with a neuropsychological battery that included a general cognitive evaluation, achievement tests, and a series of neuropsychological instruments measuring memory, attention, working memory etc. The same children were then re-evaluated after 12 months following a year of multimodal special education. A control group was also included.

**Results:** A within group comparison, between the two time-points of evaluation, and between group comparisons revealed significant gains in neuropsychological functioning (i.e. attention, working memory, achievement tests, psychological functioning, and verbal IQ) following a year of special education.

**Conclusions:** Special education continues to be the method of choice when it comes to helping children with learning disabilities. The current study revealed that Cypriot children receiving special education had neuropsychological benefits that included improvements in psychological functioning (i.e. anxiety, social functioning, and withdrawal).

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**S.H. EASON, M. GEIST, L.F. GOLDBERG & L.E. CUTTING. Reader-Text Interactions in Reading Comprehension.**

**Objective:** It is well-established that various learner characteristics contribute to successful reading comprehension; however, characteristics of reading comprehension measures themselves are also a consideration. Different text and question types may draw upon unique cognitive abilities, and therefore lead to different outcomes for individual readers.

**Participants and Methods:** To explore reader-text interactions, the Reading Comprehension subtest from the Stanford Diagnostic Reading Test-Fourth Edition (SDRT-4) was administered to 151 children (ages 11.68+1.29). Responses to items from the SDRT-4 were then classified by text (Recreational, Informational, Functional) and question (Literal, Inferential, Critical Analysis/Strategies) types. Hierarchical regression analyses were used to examine the contribution of word recognition, oral language, and executive function skills to each text and question type. Group comparisons on the SDRT-4 measures were also conducted with average readers (N=33) and children with a Specific Reading Comprehension Deficit (S-RCD; N=14) that were selected from the larger dataset.

**Results:** Results of regression analyses showed that word recognition, vocabulary, and syntax consistently contributed to performance across all text and question types ( $p < .002$ ); inferential language and executive function measures accounted for additional variance only for Textual passages and Critical Analysis/Strategies questions ( $p < .022$ ). When reader groups were compared, a text-group interaction ( $p < .01$ ) was found: while controls performed consistently on all text types, S-RCDs struggled more on Informational than on Recreational or Functional passages.

**Conclusions:** These findings suggest that distinct cognitive abilities are differentially associated with various text and question types. Children demonstrating weaknesses in executive function and inferential language may exhibit deficits on comprehension measures that place greater demands on these abilities.

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**L.H. ENGLISH, M.A. BARNES & S. LANDRY. Executive Function Development in Spina Bifida and its Influence on Preschool and School Age Academic Outcomes.**

**Objective:** Spina Bifida (SB) is a neurodevelopmental disorder of the central nervous system associated with intact word decoding skills and impaired reading comprehension, mathematical skills, and executive functioning. However, little is known about the developmental precursors of learning skills and deficits in children with this disorder. We hypothesized that infant executive abilities would predict a number of preschool and school age academic outcomes, with stronger effects emerging for math than for reading.

**Participants and Methods:** This study investigated growth in infant executive functions (working memory and inhibitory control), as measured by a delayed response cup task, in 87 children with SB and 70 typically developing children. Performance on the delayed response cup task was assessed at 12, 18, and 26 months of age. In these same children, a number of reading and math outcomes were assessed at 5 years of age (phonological processing, letter naming, counting, and calculation) and 7.5 years of age (word decoding, reading fluency, reading comprehension, calculation, and math fluency).

**Results:** Latent growth curve modeling (LGM) was used to assess whether initial status and growth in infant executive functions predicted academic outcomes at 5 and 7.5 years of age. Overall, results indicated that growth in EFs predicts an array of math and reading preschool outcomes (phonological processing, counting, and calculation skills) but only math school age outcomes (calculation skills and math fluency).

**Conclusions:** Interestingly, the impact of early executive abilities on reading was restricted to unconsolidated preschool skills. In contrast, infant executive processes affected both emerging and more formalized math skills. These results are discussed in relation to the hypothesized cognitive and neurological underpinnings of academic outcomes, as well as implications for educational planning and clinical intervention.

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**A.B. GOLD, P.T. CIRINO, L. EWING-COBBS, L.S. FUCHS & J.M. FLETCHER. Cognitive and Behavioral Attention in Children with Math Disabilities (MD).**

**Objective:** Alerting, orienting, and executive attention represent three distinct attentional processes. Alerting involves arousal of attention and maintaining an alert state. Orienting is the selection of information from sensory input. Executive attention is resolving conflict among responses. We examined the relation among these cognitive attentional networks and behavioral assessments of inattention in children with MD, in whom behavioral inattention accounts for unique variance in math performance.

**Participants and Methods:** Third grade students with MD ( $n=57$ ) and MD with Reading Disabilities ( $n=48$ ) were given the Attention Network Test (ANT), as well as various tests measuring basic mathematical skill and cognitive ability. Inattention ratings by teachers and research assistants were attained using the SWAN-IV.

**Results:** Pearson correlations showed no significant relations among Alert, Orient, and Conflict processes involved in the ANT and ratings of inattention for children with MD or MDRD. There was no significant relation between ANT and mathematical skills.

**Conclusions:** Performance on the ANT is not correlated with behavioral inattention or mathematical skills, so that these cognitive dimensions do not appear to account for the relation of behavioral inattention and MD. However, children with MD may have difficulties with other aspects of attention, such as response control and inhibition.

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**L. HAIN & J.B. HALE. Specific Learning Disability Subtypes Across Cognitive, Achievement, and Emotional/Behavioral Domains.**

**Objective:** Children with specific learning disabilities (SLD) have neuropsychological impairments that lead to academic deficits and school-based interventions. However, comorbid psychosocial problems may not be addressed, especially when SLD heterogeneity is obfuscated by collapsing affected individuals into a single group for clinical or research purposes. Recognizing the neuropsychological, academic, and psychosocial differences among SLD subtypes could foster diagnostic and treatment practices.

**Participants and Methods:** Hierarchical cluster analysis was performed on 113 WISC-IV profiles of children with SLD, determined by school team and verified by concordance-discordance psychometric criteria, to establish SLD subtypes. Subsequent academic and psychosocial deficits were explored using repeated measures MANOVA and Bonferroni post hoc analyses.

**Results:** Visual/Spatial (V/S), Fluid Reasoning (FR), Crystallized/Language (C/L), Processing Speed (PS), Executive/Working Memory (E/WM), and High Functioning/Inattentive (HF/I) subtypes were identified. Showing severe neurocognitive, academic, and behavioral impairment, C/L and E/WM subtypes appeared to have left hemisphere and frontal dysfunction respectively. The FR and V/S subtypes appeared to have right anterior and posterior deficits respectively. Both displayed math problems, but psychosocial concerns were greater in the FR subtype. Executive and attention deficits were evident in HF/I and PS subtypes, with the HF/I group experiencing Attention-Deficit/Hyperactivity Disorder symptoms and possible orbital/dorsolateral circuit impairment, and the PS group experiencing depressive symptoms and possible dorsolateral/cingulate circuit impairment.

**Conclusions:** Results suggest SLD heterogeneity can be explained by some clear and many subtle neuropsychological, academic, and psychosocial differences among subtypes. These differential SLD subtype patterns warrant careful clinical examination and individualized treatment programs.

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**K.A. HOWLAND & J. LIEDERMAN. Spoken and Written Pseudoword Learning in Dyslexia: Insight into How Dyslexic Readers Form Associations Between the Phonological and Orthographic Forms of Novel Words.**

**Objective:** Prior studies show that dyslexics have word learning deficits. We investigated how dyslexic and typical readers link meaning, spelling and pronunciation during word learning, theorizing that dyslexics will be impaired in forming associations between phonology and orthography.

**Participants and Methods:** We observed pseudoword learning in 20 typical adult readers (TYP) and 20 adults with dyslexia (DYS) matched for NVIQ. We examined the impact of 1) modality (spoken/written), 2) transfer across modality, 3) order (spoken/written first) and 4) pseudoword spelling (regular/irregular). Within 2 stories, participants learned meanings, spellings, and pronunciations of 16 pseudoword nouns (half assigned regular and half irregular spellings) matched to novel objects. Targets were balanced for orthotactic probability and neighborhood density. One story was first presented auditorially, the other visually (order counterbalanced). Novel object naming/spelling was tested at 3 points, then the procedure was repeated in the other modality.

**Results:** DYS learned pseudowords more poorly than TYP  $F(1,38)=22, p<.001$ . Additionally, there was a 3-way interaction among group, naming/spelling trials and order  $F(5,190)=2.3, p=.043$ . Group differences were found for transition from written to spoken modality,  $F(3,114)=2.9, p=.038$ . DYS showed: 1) significantly greater decline in naming accuracy immediately following the transition (MDYS: 39% to 17%; MTYP: 64% to 48%), 2) poor learning following transition, (final performance 38% compared to 81% for TYP). These group differences remained for a subgroup of participants matched on initial learning accuracy.

**Conclusions:** Compared to when DYS heard the pseudowords first, visual presentation disproportionately impaired linkage between orthographic and phonological forms. Implications are discussed relative to theories and interventions for dyslexia.

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**T.M. LEVINE, C. COLE, S.L. RIMRODT, J.R. ABEL & L.E. CUTTING. Preliminary Results of an Intensive Short-term Reading Intervention for Children with Reading Disabilities and Neurofibromatosis-Type 1 (NF-1).**

**Objective:** NF-1 is a genetic disorder characterized by a high occurrence of visuospatial impairments, and other neuropsychological and academic impairments such as reading disabilities (NF+RD). Reading Disorder (RD) is characterized by word recognition and decoding deficits thought to arise from phonological processing weaknesses.

**Participants and Methods:** In this study, children with NF+RD as well as those with RD were randomly assigned to one of two short-term intensive intervention programs: Intervention A, featuring a visual and fluency emphasis ( $n=6$ ) and Intervention B, with a phonological orientation ( $n=5$ ). The 15 hour interventions were delivered over a three to five day period. Woodcock Johnson-III (WJ-III) reading measures (Letter Word Identification, Word Attack, Passage Comprehension), as well as a fluency measure (Test of Silent Contextual Reading Fluency (TOSCRF)), were administered pre- and post- intervention. A waitlist RD group (WL-RD,  $n=5$ ) and a control group ( $n=14$ ) also completed the aforementioned measures at the pre- post- time points.

**Results:** Overall, results indicated that Intervention A and B participants showed significant improvements in performance on the WJ-III between first and second visits compared to WL-RD and Controls ( $p<.05$ ). Preliminary intervention group analyses indicated that Intervention A participants showed significant improvement on the WJ-III Word Attack subtest ( $p<.01$ ), whereas Intervention B participants displayed significant gains in fluency on the TOSCRF ( $p<.01$ ).

**Conclusions:** Although larger sample sizes are needed, our preliminary findings suggest that 15 hours of intervention can result in significant improvements in basic word reading, fluency, and reading comprehension skills for children with NF+RD and RD. Also, different tutoring approaches may be associated with disparate outcomes.

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#### **I.H. O'DESKY, J. MASSA & Z. GRATZ. Is Greater Color Naming than Word Naming on the Stroop Useful in Diagnosing Dyslexia?**

**Objective:** The Stroop Color/Word Test, a classic task of reading automaticity in which color naming is slowed down by printed words, has received considerable attention in research on Dyslexia. Research findings have indicated that high interference scores are correlated with faster reading speed. Therefore, it has been hypothesized that individuals with Dyslexia should have lower interference scores and slower reading speed. A number of studies, however, have found that children with Dyslexia have robust interference scores, but make fewer errors on Color naming compared to controls. As the Stroop Interference score is a measure of executive dysfunction and confounded with attention it may suggest that an investigation of a difference of 2 standard deviations (10 points or greater) between Stroop Color and Word Naming may be a more clinically useful indicator of Dyslexia. The present study examined whether such a difference was correlated with reading speed.

**Participants and Methods:** Participants included 10 patients (8 males) ranging in age from 9-13 who were evaluated at a central New Jersey testing center. All participants had a Full Scale IQ of 85 or above.

**Results:** The findings indicated a highly significant negative correlation between a relatively weak reading speed and good Color naming score, suggesting that individuals with better performance on Color than Word naming are slower readers.

**Conclusions:** The findings suggest that greater Color than Word naming on the Stroop may be useful in diagnosing Dyslexia. Additional research is needed to compare this pattern of performance in populations with Dyslexia, language and executive impairments.

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#### **E. MATUTE, S. GUAJARDO, A. GONZALEZ REYES & M. ROSSELLI. Age effect on writing a story in school age Mexican children: a cluster analysis.**

**Objective:** The aims of this study were to analyze the effects of age and gender on the elements of a written narrative and to cluster children into groups based on their writing performance level.

**Participants and Methods:** Two hundred and eighty Mexican children aged 7 to 16, were selected randomly. Twenty eight (14 girls) from each age were assessed. The examiner first read a story to the child, who was then asked to write it down. Six components of the narrative were scored: a) Narrative length in words, b) percent of correctly spelled words, c) errors density, d) percent of orthographic errors, e) narrative coherence and, f) writing speed.

**Results:** According to a MANOVA analysis, an effect of age was found in all measures; performance was seen to improve with age. A gender effect, with girls overcoming boys, was evident for all measures except for the percentage of orthographic errors and narrative coherence. No interaction between age x gender was shown. Afterwards three cluster analyses were run according to three age groups: G1: 7 – 8 years; G2: 9 – 11 year and G3: 12 to 16 years. Six clusters were evident for G1 and G3 and 7 clusters for G2. Most of the 7 and 8 year old children (34%) wrote slowly using few words but with a percentage of correctly spelled words and coherence level near to mean. Twenty one percent of the 9-11 year-olds wrote a long story with low error density and coherence level and speed near to mean. Finally, 31% of the 11 – 16 year-olds children showed an efficient performance with long and coherent texts, fast writing, and few errors.

**Conclusions:** Writing a story requires coordinating a series of different elements. Efficiency increases with age. However, mastering the elements involved varies across age groups according to different profiles.

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#### **G.R. MESMAN, S.L. LANCASTER & M.Y. KIBBY. Shared and Divergent Predictors of Rapid Naming Abilities.**

**Objective:** Research suggests rapid automatized naming abilities are predictive of word identification and reading comprehension; however, limited research has examined which cognitive factors are predictive of rapid naming. Furthermore, predictors of rapid naming may vary depending on the type of naming ability (e.g., letters versus objects).

**Participants and Methods:** Participants included 154 children, ages 8 to 12 years, with ADHD (n = 49), dyslexia (n = 32), comorbid ADHD/dyslexia (n = 8), other language-based impairments (n = 12) or controls (n = 53). Participants completed a neuropsychological evaluation as part of a larger study (R03 HD048752) which included the CTOPP Rapid Object Naming (RON) and Rapid Letter Naming (RLN) subtests as measures of rapid naming. Children also completed CTOPP Elision (phonological awareness) and Nonword Repetition (phonological short-term memory), WISC Processing Speed Index (PSI) and Vocabulary, and TVPS Discrimination (visual perception).

**Results:** Two regression equations were conducted using the total sample, one for RON and one for RLN. The cognitive variables above were entered using the Backward method. Both the RON (adjusted R<sup>2</sup> = .21, p < .001) and RLN (adjusted R<sup>2</sup> = .12, p < .001) equations were significant. For RON, PSI,  $\beta = .489$ , p < .001 and Vocabulary,  $\beta = -.169$ , p < .05 were predictors. For RLN, PSI,  $\beta = .281$ , p = .001 and Elision,  $\beta = .166$ , p < .05 were predictors.

**Conclusions:** RLN and RON have shared and divergent predictors. While processing speed is related to both, phonological awareness is related to RLN whereas word knowledge is related to RON.

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#### **D.J. KEARLY & D.A. MORERE. Eye Movements of Deaf Readers.**

**Objective:** Average reading of deaf adults is about fourth grade level. Some hearing dyslexics reportedly have erratic eye movements, remediation of which can improve reading skills. The current study was designed to investigate the relationship between eye movements during reading and deaf participants' reading skills.

**Participants and Methods:** Fifty-two deaf, signing college students ages 18 to 35 were recruited from a university for the deaf. Participants were administered a demographic questionnaire and computerized vision screening, then the PIAT-R Reading Comprehension, TOSWRF, and phonological and lexical measures from the PALPA. Eye movements were measured during reading of three passages followed by comprehension questions.

**Results:** Pearson Correlations found a negative relationship between word reading fluency and number of fixations. Curve estimation regression analysis found a weak significant quadratic relationship between reading comprehension and fixation duration for the 3rd grade passage. Spearman correlations found no relationship between either reading measure and number of regressions. Strong positive Pearson correlations were found between the two reading measures and all PALPA tests.

**Conclusions:** Reading fluency was significantly related to number of fixations; reading comprehension was not. Some readers may have good comprehension despite weak fluency and eye movement skills. The relationship between reading ability and fixation duration variability may be curvilinear, explaining the conflicting results in prior research. Reading comprehension and silent word reading fluency correlated highly with both lexical and phonetic skills in deaf readers, supporting previous research indicating that both phonetic awareness and lexical abilities are critical skills for deaf readers.

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L. CHAPMAN, C.A. NOGGLE, K. BAXTER, C. SADLER & R.S. DEAN. **Associated Neurocognitive Profiles of Differential Learning Disabilities.**

**Objective:** Conceptually, learning disorders correspond with underlying neurological dysfunction that primarily impede academic achievement; however, expectations of additional neurocognitive compromise remain feasible as the brain remains a dynamic system with shared interconnections. The current study sought to outline the differential cognitive profiles of various learning disabilities.

**Participants and Methods:** An archival data set was utilized for the present study. Participants included 244 children diagnosed with dyslexia, 364 children diagnosed with dyscalculia, and 468 diagnosed with dysgraphia who were all administered the WJ III –Cognitive as part of a neuropsychological evaluation.

**Results:** Multivariate analysis revealed significant discrepancies did in fact exist between groups,  $F(36,2114) = 5.192, p < .001$ . A significant discriminant function resulted with a combined  $\chi^2(36) = 183.031$ . Structure matrices suggested children with dyscalculia performed significantly worse than those with dyslexia and/or dysgraphia on analysis-synthesis, concept formations, spatial relations, and visual-auditory learning. Children with dysgraphia performed significantly worse on planning than did children with dyslexia or dyscalculia as well as worse on general information than did those with dyslexia. Finally, those with dyslexia performed significantly worse than did those with dyscalculia and/or dysgraphia on incomplete words.

**Conclusions:** Results are unique in that they demonstrate these well-known academic dysfunctions as manifestations of specific underlying neurological networks that are truly discrepant from one another. Outlining of the neurocognitive profiles associated with each learning deficit may assist in identification of these presentations, but may also suggest associated areas of weakness that may be expected in the presence of such manifestations that may warrant additional interventions.

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A. ORVIS, A. ROZMARYNOWSKI, S. TRINASTIC, R. LEIDEL, Q. MANO & D.C. OSMON. **Experimental Orthographic Tasks and Reading Ability: Word Jumble Task.**

**Objective:** The Word Jumble task (Hultquist, 1996) evaluated lexico-semantic components of orthographic processing in a divided visual field methodology using a learning problem sample. Since specific, compared to global intellectual, cognitive processes are important in reading disorder the present results may be useful in further elucidating lateralized aspects of the specific cognitive deficits in dyslexia.

**Participants and Methods:** 54 college students referred for learning disability testing and were divided into good vs. poor reading ability as measured by the Woodcock-Johnson battery (WJ-III) Broad Reading score. The Word Jumble task asked participants to detect which laterally presented letter string contained an embedded word (e.g., WKTSNSOFTSPKIHE).

**Results:** Only RVF accuracy of the Word Jumble task discriminated good from poor readers ( $t[52]=2.78, p < .001$ ). Correlations between the orthographic measures and cognitive scores showed small relationships with language, attention, and spatial scores.

**Conclusions:** As expected, specific cognitive processes were found to be important in the present learning problem sample and several conclusions are suggested:

1. lexico-semantic processes are associated with the RVF,
2. good and poor readers do not differ in reaction time to orthographic stimuli as reflected in the Word Jumble task,
3. reaction time measures do not relate well with typical intelligence and neuropsychological measures, suggesting incremental validity to the typical psychoeducational assessment of reading skills,
4. left visual field reaction time related to processing speed, attention and language abilities, arguing for a role of the right cerebral hemisphere in early visual perceptual processing of word forms.

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R. LEIDEL, S. TRINASTIC, A. ROZMARYNOWSKI, A. ORVIS, Q.R. MANO & D.C. OSMON. **Experimental Orthographic Tasks and Reading Ability: Pseudohomophone Task.**

**Objective:** The Pseudohomophone task (after Olson, Wise, Conners, Rack, & Fulker, 1989) evaluated lexico-semantic components of orthographic processing in a divided visual field methodology using a learning problem sample. Since specific, compared to global intellectual, cognitive processes are important in reading disorder the present results may be useful in further elucidating lateralized aspects of the specific cognitive deficits in dyslexia.

**Participants and Methods:** 54 college students referred for learning disability testing and were divided into good vs. poor reading ability as measured by the Woodcock-Johnson battery (WJ-III) Broad Reading score. Participants discriminated a real from a pseudohomophone word (e.g., Dream or Dreem) one presented to either visual field.

**Results:** Only RVF accuracy of the Pseudohomophone task discriminated good from poor readers ( $t[52]=20.28, p < .001$ ). Correlations between the Pseudohomophone task measures and intellectual and neuropsychological scores showed small relationships with processing speed (Gs), crystallized (Gc), visual processing (Gv), and short-term memory (Gsm).

**Conclusions:** As was found for in prior studies in our lab with word level tasks, specific cognitive processes were found to be important in the present learning problem sample and several conclusions are suggested:

1. lexico-semantic processes are associated with the RVF and differentiate good and poor readers,
2. reaction time measures do not relate well with typical intelligence and neuropsychological measures, suggesting incremental validity to the typical psychoeducational assessment of reading skills,
3. the orthographic accuracy measures capture abilities that have been shown to relate to reading skills, including Gc, Gs, and Gv.

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S. TRINASTIC, R. LEIDEL, A. ORVIS, A. ROZMARYNOWSKI, Q.R. MANO & D.C. OSMON. **Experimental Orthographic Tasks and Reading Ability: Homophone Task.**

**Objective:** The Homophone task (after Stanovich, West, & Cunningham, 1991) evaluated lexico-semantic components of orthographic processing in a divided visual field methodology using a learning problem sample. In the present task, homophones, instead of the more difficult pseudohomophones used in a prior study, were used with the assumption that poor readers would have difficulty in RVF presentation compared to good readers.

**Participants and Methods:** 54 college students referred for learning disability testing and were divided into good vs. poor reading ability as measured by the Woodcock-Johnson battery (WJ-III) Broad Reading score. Participants discriminated two homophones based upon a priori criteria (e.g., 'dew' vs. 'do') one presented to either visual field.

**Results:** Neither reaction time nor accuracy of the Homophone task discriminated good from poor readers. Correlations between the orthographic measures and intellectual and neuropsychological scores revealed minimal relationships.

**Conclusions:** Unexpectedly, given other word level relationships on the Word Jumble (Orvis et al., 2008) and Pseudohomophone (Leidel, et al., 2008) tasks, we found the Homophone word-level orthographic task did not discriminate good and poor readers, suggesting the following:

1. negative results suggest that the prior lexico-semantic orthographic tasks do not discriminate good and poor readers on the basis of visual perceptual orthographic ability,
2. it is unlikely that difficulty alone accounts for the differential sensitivity of lexico-semantic tasks to reading skill since the relationship occurs in only one visual field (RVF),

3. prior lexico-semantic tasks have a greater executive components compared to the present task, suggesting the orthographic deficit in poor readers may relate to executive aspects of reading.

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**A. ROZMARYNOWSKI, A. ORVIS, R. LEIDEL, S. TRINASTIC, Q.R. MANO & D.C. OSMON. Experimental Orthographic Tasks and Reading Ability: Word Matching Task.**

**Objective:** The Word Matching task (after Brand, Van Bakkum, Stumpel, & Kroeze, 1983) evaluated lexico-semantic components of orthographic processing in a divided visual field methodology using a learning problem sample. Since the matching process could be more purely visual in nature compared to prior orthographic tasks, the orthographic processes were expected to differentiate good and poor readers in the right visual field.

**Participants and Methods:** 54 college students referred for learning disability testing and were divided into good vs. poor reading ability as measured by the Woodcock-Johnson battery (WJ-III) Broad Reading score. Participants identified an originally presented word from among a visual, phonetic, and semantic foil.

**Results:** Both RVF and LVF accuracy of the Word Matching task discriminated good from poor readers ( $t[52]=2.65$  &  $2.28$ ,  $p<.05$ ). Correlations between the Word Matching task measures and intellectual and neuropsychological scores revealed small relationships with processing speed (Gs) and spatial measures.

**Conclusions:** As was found in prior studies in our lab with word level tasks, specific cognitive processes were found to be important in the present learning problem sample, suggesting the following:

1. prior findings of a lateralized finding were not confirmed,
2. perhaps lexico-semantic processes are not necessary since the Word Matching task can arguably be accomplished simply by visual perceptual matching-to-sample processes,
3. results support growing evidence that right hemisphere processes are important in word recognition (Patrick, Flynn, & Osmon, 2007), and
4. the curious result of Word Matching accuracy measures relating to processing speed even when the reaction time measures did not bears further exploration.

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**K.P. RAGHUBAR, L.M. TRICK & M.A. BARNES. The Role of Working Memory and Finger Representation in Single-Digit Calculation.**

**Objective:** Various cognitive developmental and neuropsychological models propose that working memory resources and finger representations are implicated in mathematical ability and disability. The role of the working memory slave systems and finger representation in single-digit calculation was investigated in 45 undergraduate students using a dual task paradigm. Individual differences in verbal and visual-spatial working memory as sources of variation in simple arithmetic and dual task interference were also examined.

**Participants and Methods:** Small- and large-size addition, subtraction, and multiplication problems were presented alone (baseline condition) or while participants performed subsystem-specific secondary tasks: articulation, sequential tapping, or spatial tapping. Errors and response times were measured. Standardized measures of verbal and visual-spatial working memory and math fluency were also administered.

**Results:** The secondary tasks all impaired single-digit calculation performance, but sequential and spatial tapping produced more interference than articulation. Secondary task interference was twice as large for those with low as compared to high visual-spatial working memory. While individual differences in visual-spatial working memory were related to performance on the single-operation experimental measures, individual differences in verbal working memory were related to performance on the mixed-operation standardized test of arithmetic fluency.

**Conclusions:** Overall, results highlight the importance of visual-spatial working memory and finger resources in simple arithmetic tasks. As well they suggest the need to take into account individual differences in working memory in the interpretation of single-digit calculation findings using dual task methodology, and to pay attention to processing requirements in mathematical tasks (i.e., single- versus mixed-operation problem sets) when determining what aspects of working memory are related to arithmetic.

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**H. SOTOZAKI, B. HATIN, M. HAHN & S. PARLOW. Interhemispheric Integration: No Advantage of Bilateral Presentation in General Poor Readers in a Primed Lexical Decision Task.**

**Objective:** Previous studies indicate when a task demand increases, bilateral presentation is more advantageous than unilateral presentation. The present study investigated whether or not this advantage occurs in poor readers (no dyslexics) to enhance reading efficiency in a primed lexical decision task using a visual half-field paradigm.

**Participants and Methods:** In Experiment 1, a temporal variable was manipulated. The ISI-200 group (easy task;  $n = 26$ ; age range: 19 to 25) and ISI 750 group (difficult task;  $n = 30$ ; age range: 18 to 24) were compared. Their standardized reading scores were above 95. Repeated-Measures of ANOVAs were used to analyze reaction time and accuracy data. In Experiment 2, the 9 undergraduate students, whose standardized reading scores were below 95, were served as poor readers and compared with the 30 undergraduate students from Experiment 1 (ordinal readers).

**Results:** The ANOVA demonstrated a significant unilateral advantage for the ISI-200-ms ( $p = .026$ ) and a significant bilateral advantage for the ISI-750-ms ( $p = .004$ ) in accuracy. We confirmed the previous findings, suggesting that when a task becomes difficult, ordinal readers change cognitive strategies from unilateral to bilateral processing to enhance efficiency. In Experiment 2, the group difference was significant ( $p = .049$ ). The poor readers' data were separately analyzed by an ANOVA. No significance was found in Condition.

**Conclusions:** The poor readers did not show the advantage of bilateral presentation in the difficult task, suggesting that their poor reading ability may stem from a failure to change strategies from unilateral to bilateral processing to enhance reading efficiency.

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**K.K. STUEBING, A.E. BARTH, P.J. MOLFESE, B. WEISS & J.M. FLETCHER. IQ is Not Strongly Related to Response to Reading Instruction: A Meta-Analytic Interpretation.**

**Objective:** The role of IQ test scores for the identification of children with learning disabilities continues to be controversial. Recent qualitative reviews (Fletcher, Lyon, Fuchs, & Barnes, 2007, Fuchs & Young, 2006) have come to opposite conclusions about the utility of IQ in predicting response to instruction in early reading. The current study was undertaken in an attempt to shed light on this disagreement via a quantitative review of the same studies plus more recent literature and to consider the utility of the size of the effect found via this method.

**Participants and Methods:** 22 studies evaluating the relation of different assessments of IQ and intervention response were located. The correlation between IQ and intervention response was coded both with and without covariates. Effect sizes were estimated from any available data and the degree of estimation for each effect was coded as a possible moderator. For many studies, a low and high estimate of the effect size was calculated. Distributions of effects were tested for heterogeneity and both high and low estimated mean effects with confidence intervals were calculated using Hunter & Schmidt (1990) meta-analytic methods.

**Results:** We found an  $R^2$  of .03 in models with IQ and the autoregressor as predictors and a unique lower estimated  $R^2$  of .004 and a higher estimated  $R^2$  of .011 in models with IQ, the autoregressor, and additional covariates as predictors. There was no evidence that these aggregated effect sizes were moderated by variables such as the type of IQ measure, outcome, age, or intervention.

**Conclusions:** These results did not support the hypothesis that IQ is an important predictor of response to instruction.

In simulations of the capacity of variables with effect sizes of .03 and .001 for predicting response to intervention, we found little evidence of practical significance. In contrast, brief assessments of academic skills at baseline may have much larger effect sizes and dramatically improve predictions of instructional response.

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**K. THOMAS, N. HENRICKSON, R. LAJINESS-O'NEILL, P. LEWANDOWSKI-POWLEY, A. CHASE, J. GDOWSKI & S.M. BOWYER. Magnetoencephalography (MEG) Profiles of Learning Disorders.**

**Objective:** The validity of DSM-IV-TR discrepancy criteria for diagnosing learning disability (LD) is much debated. Magnetoencephalography (MEG) can examine cortical activation patterns during tasks necessary for successful reading and may be a valid and reliable method for diagnosing LD and its subtypes.

**Participants and Methods:** Four subjects with LD classified according to evidence-based criteria (Fletcher et al., 2005) (Males = 2; Mean age = 23) and four controls (Males = 3; Mean age = 19) underwent MEG during reading tasks for which they had to distinguish between phonological and orthographic discrepancies; a skill necessary to read "along with" another. Data was analyzed with MR-FOCUSS (Moran et al., 2005), a current density imaging technique.

**Results:** Mismatch: Controls - left MTG, ANG/SMG at early latencies (120-170 ms), left temporal and bilateral SMG/ANG at mid latencies (210-300 ms) and left ITC/MTG (340-430 ms). Dyslexics - bilateral temporal and frontal (IFG/MFG/SFG) regions at early latencies and bilateral precuneus, MFG/SFG (220-290 ms) at mid latencies.

Pseudoword: Controls -bilateral ANG/SMG, precuneus, left putamen (120-180 ms), and right cingulate (190-280 ms) at early and left temporal, post-central, and precuneus at mid latencies (180-330 ms). Dyslexics - activated earlier in bilateral postcentral regions, and in MTG/STG (140-190 ms), IFG/MFG (180-280 ms); at mid latencies, bilateral SMG and left postcentral regions (230-330 ms); and later frontal regions (380-480 ms).

**Conclusions:** The findings suggest compensatory earlier bilateral frontal, temporal and possibly postcentral and precuneus activation in dyslexia and the utility of MEG in the diagnoses of LD. Subtype patterns of LD are also discussed.

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## FRIDAY AFTERNOON, FEBRUARY 13, 2009

### Poster Session 8: Child TBI, Genetics, Medical/Neurological Disorders, Emotion

1:15–2:45 p.m.

#### Emotional Processes

**K. ALTERESCU, J.C. BOROD, D.L. MCCABE, K.J. ROGERS, A. GOLD, P. GROSSMAN & K. SCORPIO. Mechanisms Underlying the Hemispace Bias for Processing Emotional Faces.**

**Objective:** The Chimeric Faces Task (CFT; Levy et al., 1983) has been widely used to study hemispheric specialization for facial emotion in free-field viewing. The aim of this study was to examine mechanisms underlying the hemispace perceptual bias for the CFT by assessing the relative contribution of several affective and cognitive variables. Sex differences were examined due to their documented impact (Lezak et al., 2004) on emotional processing and laterality.

**Participants and Methods:** Participants were 107 (50 men, 57 women), who had no history of psychiatric, neurological, or major medical disorder. In addition to the CFT, the following variables were assessed via the measure indicated: facial emotional identification (Facial Emotion Identification; Borod et al., 1992), neutral face recognition (Benton Face Recognition Task; Benton et al., 1983), visuospatial perception (Visual Matrices; Borod et al., 1993), and spatial attentional bias (Greyscales Task; Mattingley et al., 1994).

**Results:** Overall, both men and women had significant ( $p < .001$ ) left-hemispace biases on the CFT. Mechanisms underlying the CFT were examined using a series of hierarchical linear regression analyses via block-wise entry based on a priori hypotheses. After all four variables were entered, models for both men ( $p = .05$ ) and women ( $p = .019$ ) were significant. Facial emotional perception and visuospatial perception each accounted for a significant proportion of the variance for women, whereas spatial attention accounted for a significant proportion of the variance for men.

**Conclusions:** Our results indicate that mechanisms associated with the chimeric faces perceptual bias are dissociable in men and women. These findings add to the body of literature investigating emotional and spatial biases.

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**U. CLARK, M. WESTBROOK, K. DEVLIN & R.A. COHEN. Recognition of Emotional Facial Expressions in Individuals Infected with the Human Immunodeficiency Virus (HIV) Correlates with Length of HIV Infection.**

**Objective:** HIV infection is associated with frontostriatal pathology. Cognitive deficits consistent with such neuropathology are commonly reported. Several studies have noted impaired facial emotion recognition abilities in disorders associated with frontostriatal dysfunction. Yet, this is the first study to date to report on facial emotion recognition in HIV.

**Participants and Methods:** We included 29 non-demented HIV+ (21 men) and 26 demographically comparable seronegative healthy control (HC; 15 men) participants (age range: 23-64 years). Mean length of HIV infection was 13.07 years (SD=9.08 years). Participants viewed 84 Ekman and Friesen photographs (12 each: Anger, Disgust, Fear, Happiness, Sadness, Surprise, and Neutral) and identified the expressed emotion from a list of 7 emotion labels. Percent correct recognition was calculated for each emotion.

**Results:** No group differences in facial emotion recognition were observed. Correlations between emotion recognition and age, CD4 Nadir, and current CD4 levels were non-significant. Greater length of infection correlated with increased Disgust and decreased Surprise recognition.

**Conclusions:** Although this preliminary study did not reveal differences in facial emotion recognition between HIV and HC, the observed relation between length of infection and emotion recognition suggests that frontostriatal dysfunction may contribute to emotional processing problems among individuals with HIV. These results are consistent with a

premature-aging hypothesis of HIV neuropathology, as greater Disgust recognition has been reported in older compared to younger adults. Additionally, the association between reduced Surprise recognition and length of infection is consistent with previous findings implicating frontostriatal systems in emotion recognition.

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**W.D. KILLGORE & D.A. YURGELUN-TODD. Cerebral Correlates of Amygdala Responses During Non-Conscious Perception of Affective Faces in Adolescent Children.**

**Objective:** Studies of adults have demonstrated the presence of two separate neural systems for processing facial affect. Conscious perception of affect involves the geniculostriate system, a relatively slow pathway from the retina through the lateral geniculate nucleus to the primary visual cortex and higher visual association regions. A second and much faster system for nonconscious perception of biologically relevant information includes a more direct pathway involving the superior colliculus, pulvinar, and right amygdala. This second system permits rapid responses to affectively relevant information perceived below the threshold of conscious awareness. It is not known whether the extrastriate system is fully developed in children or whether this system continues to develop throughout adolescence and into adulthood.

**Participants and Methods:** Twenty-three healthy adolescents underwent functional magnetic resonance imaging (fMRI) while viewing fearful, angry, and happy faces, during a masked perceptual paradigm that prevents conscious identification of the expressions.

**Results:** Activation of the left amygdala correlated positively with activation within limbic, paralimbic, ventral striatal, and extrastriate cortex, and inversely with activity in prefrontal, insular, and primary visual cortex ( $p < .01$ , corrected). In contrast, the right amygdala was not significantly activated.

**Conclusions:** These findings provide support for the presence of an extrastriate pathway for processing masked visual images with affective relevance, further extending this model to encompass the developmental period of adolescence. Although this non-conscious affect processing system appears to operate in a manner similar to that observed in adults, these preliminary findings suggest that the laterality of amygdala responses may differ in adolescents relative to previously published adult samples.

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**W.D. KILLGORE, J.C. BRITTON, L.M. PRICE, A.L. GOLD, T. DECKERSBACH & S.L. RAUCH. Introversion is Associated with Greater Amygdala and Insula Activation During Viewing of Masked Affective Stimuli.**

**Objective:** The construct of introversion/extraversion is a core dimension of most theories of personality and may be linked to neurobiological substrates associated with risk for mood or anxiety disorders. Whereas extraverts seek out social stimulation, introverts tend to be more reserved and socially uncomfortable. Recent functional magnetic resonance imaging (fMRI) studies suggest that extraversion (i.e., lower introversion) is associated with greater functional responses of the amygdala to consciously perceived emotional stimuli. The amygdala is also part of an extrastriate network involved in non-conscious threat/arousal detection and is often activated by subtle social stimuli outside of conscious awareness. No studies have examined the relationship between introversion/extraversion and corticolimbic responses to socially relevant stimuli presented below the level of conscious awareness.

**Participants and Methods:** Accordingly, we correlated fMRI responses of 14 healthy adults in during backward masked presentations of faces

expressing either happy or fearful affect with Extraversion scores on the NEO-FFI. We hypothesized that Extraversion would be negatively associated with limbic responses to masked affect. Search territories were restricted to the bilateral amygdala and insula ( $p < .005$ , uncorrected,  $k=10$ ).

**Results:** For masked fearful faces, greater introversion (i.e., lower extraversion) was associated with greater activation of the left amygdala, and bilateral insular cortex (predominantly left lateralized). For masked happy faces, greater introversion was significantly correlated with greater bilateral activation of the amygdala and insular cortex (predominantly left lateralized).

**Conclusions:** Findings point to a neurobiological basis for increased sensitivity to socially induced arousal, threat, or interoceptive signals within introverted individuals, which may contribute to the phenotype of socially avoidant behavior.

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**A.S. LEE, M. SOLLBERGER, C.M. STANLEY, S. GLENN, B.L. MILLER & K.P. RANKIN. Auditory and Visual Processing of Emotions Show Divergent Neuroanatomy in Neurodegenerative Disease.**

**Objective:** Emotional information is usually perceived simultaneously via visual (e.g., facial, body, and gestural expressions) and auditory modalities (e.g., prosody, propositional content). Functional imaging suggests bilateral temporal and frontal networks mediate emotion recognition in both modalities, but few structural imaging studies have attempted to delineate distinct networks for auditory and visual emotion processing.

**Participants and Methods:** To investigate whether modality-specific affect perception derives from distinct neuroanatomic structures, 77 subjects (13 frontotemporal dementia, 10 semantic dementia, 4 progressive nonfluent aphasia, 6 corticobasal degeneration, 6 progressive supranuclear palsy, 18 Alzheimer's, 20 older normal controls) underwent the Emotion Evaluation subtest of The Awareness of Social Inference Test (TASIT), in which actors display 7 basic emotions (happiness, surprise, neutral, sadness, anger, fear) in 20-second videos. Clips were played in two formats: 1) full audio and visual, 2) visual included but audio removed. We used voxel-based morphometry to investigate the relationship between brain volume and TASIT scores under both conditions. All analyses covaried for age, sex, MMSE, and total intracranial volume.

**Results:** Under the natural, audiovisual condition, poor scores correlated with bilateral rostromedial orbitofrontal cortex (OFC) atrophy (FWE  $p < 0.05$ ). However, diminished emotion naming in the visual-only condition correlated with atrophy in the right caudate head (peak MNI coordinates: 4, 8, 6) in addition to the medial OFC.

**Conclusions:** This result confirms previous structural studies suggesting that medial OFC damage negatively impacts emotion naming. Also, it suggests that the basal ganglia may become more important for emotion processing when perceptual cues are attenuated, particularly when both auditory and content information are unavailable.

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**H.M. LEON, S.A. LANGENECKER, A.M. KADE, L.M. FRANTI, M. SCHALLMO, A. VEDERMAN, E.F. SAUNDERS & M.G. MCINIS. Emotion Processing Decrements are Related to Symptoms of Depression, Age, and Gender, but not Major Depressive Disorder or Bipolar Disorder.**

**Objective:** Emotion processing abnormalities are increasingly being viewed as a critical feature of major depressive and bipolar disorders (MDD, BD). It is currently unclear whether these abnormalities in processing reflect the illnesses, or may in fact be related to depressive symptoms. We hypothesized that decreased accuracy on emotion perception tasks, both auditory and visual, would be observed in those with MDD and BD.

**Participants and Methods:** There were 101 control participants, 58 participants with MDD, and 106 participants with BD on average of 37.5 years old and with 15.6 years of formal education. The Facial Emotion Perception Test (FEPT) is a visual based task in which pictures of human faces with different emotions are briefly presented. The Emotion Perception Test is an auditory task in which a recorded female voice dictating sentences in English with different emotional inflection are presented. For both tasks participants select the emotion that was depicted in the picture/sentence (happy, angry, fearful, or sad).

**Results:** Preliminary data analysis on the total number of errors and errors for different emotional stimuli has shown that there was no effect of group on performance for either task. Additionally, it was observed that errors increase significantly with auditory presentation, increasing depression symptoms, increasing age, and in males compared to females.

**Conclusions:** This study highlights the complexity of determining neuropsychological substrates of emotion processing in MDD and BD. We show that difficulties in emotion processing may be related to active depression symptoms (a state feature) and not the disorders themselves.

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#### **E. LUTHER, R. BERMAN & D. TUCKER. The Role of the Amygdala in Emotional Memory.**

**Objective:** The purpose of the current study was to explore whether laterality effects exist in the amygdala during recall depending on the emotional valence and the material content (eg. verbal versus pictorial) of the stimulus.

**Participants and Methods:** Five healthy, right handed college educated adults participated in a single fMRI session in a GE 3T scanner. Participants were asked to view and remember two sets of 60 pictures rated for emotional valence (20 positive, 20 negative & 20 neutral for each set) taken from the International Affective Picture System. Each stimulus was presented for 3 seconds and each set of pictures presented 3 times. Participants were then asked to recognize previously presented pictures versus foils. Functional MRI data was acquired during the recognition phase as an event design. An identical procedure was used for presentation of two sets of 60 words rated for emotional valence taken from the Balanced Affective Word List Creation Program.

**Results:** Results showed primarily left amygdala activation for recognition of all word classes but right activation for the negative words only. For images there was bilateral amygdala activation for positive and neutral pictures, but only the right amygdala showed activation for negative stimuli.

**Conclusions:** These data suggest that there is some material specificity to amygdala activation with the left more involved with verbal stimuli. Also, consistent with previous research, the right amygdala appears to play a primary role with the recall of negative stimuli in both the verbal and visual modalities.

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#### **K. POLLARD, K.J. MILLER, J. KRAVITZ, V. FERLA, J. KIM, L. ERCOLI, A. KAPLAN, D. DORSEY & G.W. SMALL. The Effects of Chronic Distress on Cognitive Status in Older Adults.**

**Objective:** Stress is known to cause chemical changes in the brain as hormones are released and absorbed in response to stress. Prior research has suggested that chronic stress over one's lifetime may lead to permanent changes in the brain and thus cognitive functioning. This current study will evaluate the relationship between chronic distress and cognitive status in older adults.

**Participants and Methods:** Participants (N = 131) were divided into three groups according to cognitive status (intact cognition (n = 139),

mild cognitive impairment (MCI) (n = 21), and dementia (n = 21). The sample included: 64 males and 117 females ages 50-89. Participants completed the Hamilton Depression Scale, Hamilton Anxiety Scale, Geriatric Depression Scale, State-Trait Anxiety Scale and the Profile of Mood States (POMS).

**Results:** A linear multiple regression using cognitive status (intact, MCI, dementia) as the dependent variable, and chronic distress, as measured by the HAM-D, HAM-A, GDS, State-Trait, and POMS as the independent variable, revealed a relationship between chronic distress and cognitive status ( $p < .05$ ). The measure that most significantly contributed to the relationship between chronic distress and cognitive status was the POMS, in particular the subscales of Anger and Confusion.

**Conclusions:** These results suggest that there is a significant relationship between higher levels of chronic distress and reduced cognitive functioning in older adults. Results further suggest that this relationship is most affected by one's level of anger and confusion. Implications are discussed.

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#### **X. SUN, Y. LIU, Z. JIANG & L. YANG. Individual difference of brain mechanism underlying emotional activity in children.**

**Objective:** It is observed from daily life that for some people, their emotional state interferes their cognition, while for other people their emotional state facilitates their cognition. What cause the differences? This study is to investigate the physiological mechanism for individual difference when cognition and emotion interact.

**Participants and Methods:** Twenty-four five year-old children were studied via a subliminal Stroop experiment with event-related potential (ERP) recording. The behavioral reaction times in emotional and neutral conditions were used to divide the children into emotion-interference (EI) and emotion-facilitation (EF) groups.

**Results:** The brain mechanism of emotion-related processing of these two groups was different as evidenced by the ERP result. When processing emotional stimuli, the EI group activated more at the early stage of cognitive processing as evidenced by an increase in P2 amplitude, while the lack of resources at the late stage of processing caused less activation as evidenced by a decrease in N4 amplitude. The processing pattern for the EF group was the reverse of that for the EI group. For both groups of children, the left hemisphere was more sensitive to emotional processing. In addition, the positive and negative emotional information showed a similar pattern in the emotional and cognitive processing.

**Conclusions:** This study showed the direction of amplitude change interacted with the participant group. It suggests that there exists individual difference on how the brain responds to emotional information. Correspondence: *Xiaojie Sun, PhD, School of International Business Communication, Dongbei University of Finance and Economics, No 217, Street Jianshan, District Sha Hekou, Dalian 116025, China. E-mail: xiaojiesun@sina.com*

#### **A. VEDERMAN, H. LEON, S.L. WRIGHT & S. LANGENECKER. Affect stimulus modality and perceptual accuracy.**

**Objective:** Affect paradigms have been used increasingly over the past decade, yet little is known about behavioral parameters such as accuracy, or about how stimulus modality may influence perceptual accuracy.

**Participants and Methods:** Subjects were 42 male and 59 female healthy controls aged 18 to 66 (Mean 35.26) and between 12 to 22 (Mean 15.58) years of education. Subjects were administered the Emotional Perception Test (EPT) and Facial Emotional Perception Test (FEPT). On these tasks subjects were asked to correctly pair target stimuli with corresponding affect labels in both auditory (EPT) and visual (FEPT) modalities. Errors were recorded across tasks and within emotional categories (happiness, anger, fear, and sadness).

**Results:** Total errors on the EPT and FEPT were marginally correlated ( $r = .36, p < .001$ ). Total errors between tasks and across affect cate-

gories varied. Subjects made significantly more total errors on EPT relative to FEPT ( $F(1, 100)=35.9, p=.0001$ ). Individuals demonstrated fewer errors for angry auditory stimuli and for happy visual stimuli in a significant interaction between stimulus mode and type ( $F(3, 98) = 112.3, p < .0001$ ). Females made fewer errors than males identifying sad stimuli in the auditory domain ( $r = -.218, p < .05$ ). Age was also associated with total errors on both the EPT and FEPT ( $r = .295, p = .003$  and  $r = .202, p = .043$  respectively).

**Conclusions:** This is one of the first studies to explore accuracy relationships across stimulus modalities, suggesting that separate neurobiological mechanisms may be at play in processing much of this information, and arguing against a more general emotion processing construct.

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**J. WETHERINGTON, Y. LIU, C. JANELLE, H. HAUSENBLAS & P. WRIGHT. Relationships Among Emotion, Motivation, and Exercise Behavior: Regular Exercisers' and Sedentary Individuals' Subjective and Cortical Response to Exercise Stimuli.**

**Objective:** The purpose of this study was to examine the influence of perceptions of physical activity on self-report and cortical responses to exercise stimuli in a laboratory setting.

**Participants and Methods:** A total of ten healthy, right-handed women, aged 21 to 30, participated in the study. The regular exercise group included 5 women, all of whom reported running for at least 30 minutes on an average of five days per week, for a minimum of 3 months, and who expressed an enjoyment for running. The sedentary individual group consisted of five women, who were not engaging in any type of regular exercise currently and who disliked running. The experimenters presented exercise-related stimuli visually and auditorily during an fMRI scan to determine differences between regular exercisers' and sedentary individuals' responses to physical activity stimuli.

**Results:** Areas of the brain associated with positive and negative affect (e.g., ventral striatum, amygdala) demonstrated differential activation between groups. Sedentary individuals displayed greater brain activation in the amygdala in response to pictures of elite runners and in the left amygdala/ventral striatum in response to pictures of athletic women. Differences in patterns of activation were also found in the prefrontal cortex (MDPFC and VLPFC). Pictures of elite runners elicited greater activation from sedentary individuals than regular exercisers. Conversely, regular exercisers demonstrated significantly greater activation in the VLPFC while imaging running-related scripts. Sedentary individuals consistently displayed greater brain activation in both hemispheres of the cerebellum for pictures of athletic women and elite runners.

**Conclusions:** These findings suggest that differences in the emotional perception of exercise exist between groups, as measured by cortical patterns of activation. Results from this study offer rudimentary support for differences between regular exercisers' and sedentary individuals' cortical representations of physical activity.

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## Genetics/Genetic Disorders

**D. BAKER & J. KIEFEL. Neuropsychological Profile of a 10 year-old with Turner Syndrome: A Longitudinal Case Study with Developmental Implications.**

**Objective:** Turner Syndrome (TS) is a rare genetic disorder affecting roughly 1 in 2000 females (NIH, 2005). While phenotypes can vary across cases, a common neuropsychological profile has been well-documented in the literature including visual spatial deficits, fine and gross

motor dysfunction, as well as academic difficulties in math. Social and emotional deficits also are frequently reported in this population. This is often displayed within the context of relatively intact and even exceptional verbal abilities. Given this neurocognitive profile, a common comorbid condition in TS is that of a nonverbal learning disability (NLD).

**Participants and Methods:** The subject is a 10 year-old girl diagnosed with TS at age 4. Neuropsychological evaluations were conducted at age 4 and again at age 10. Data from both neuropsychological evaluations, as well as parent and teacher reports were collected.

**Results:** Data from both evaluations are consistent and reveal a significant discrepancy between verbal and nonverbal intellectual performance at age 4 (128 vs. 84) and again at age 10 (116 vs. 75). Visual-spatial and fine motor deficits also were documented across both evaluations, while verbal abilities remained consistent areas of strength. Additional deficits were found on the more recent evaluation in the area of executive functioning and in social-emotional functioning. Specifically, organization and planning deficits were found, along with concerns in the area of social withdrawal.

**Conclusions:** Our case documents the stability of neuropsychological areas of strength and weakness in a child diagnosed with TS, with additional concerns in the areas of executive functioning and emotional adjustment at a later developmental stage.

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**A. BENITEZ, J. GUNSTAD, K.F. HOTH, J. MCCAFFERY, J. MCGEARY, L.S. KAKOS, A. POPPAS, R.H. PAUL, A.L. JEFFERSON, L.H. SWEET & R.A. COHEN. SELP 1087G/A Polymorphism is Associated with Neuropsychological Test Performance in Older Adults with Cardiovascular Disease.**

**Objective:** There is growing evidence that the cell adhesion molecule P-selectin (SELP) contributes to the adverse vascular processes that promote cognitive impairment in individuals with cardiovascular disease. Previous research has shown that SELP genotypes moderate circulating levels of P-selectin, wherein persons with the SELP 1087A allele were (1) less likely to show post-operative cognitive decline, and (2) more likely to exhibit lower levels of C-reactive protein than non-carriers. Thus, we expected that carriers of the 1087A allele would exhibit better cognitive functioning than non-carriers (i.e. those with two 1087G alleles) in this sample of older adults with CVD, and that CRP levels would be important for this relationship.

**Participants and Methods:** 120 older adults with diagnosed CVD were recruited from outpatient cardiology clinics. Each participant underwent a comprehensive neuropsychological test battery and a blood draw.

**Results:** Participants with the SELP 1087A allele performed more poorly on tests of attention [TMT-A:  $t(116)=3.20, p=.002$ ], executive function [TMT-B:  $t(116)=2.89, p=.005$ ], psychomotor speed [Digit-Symbol Coding:  $t(117)=2.54, p=.012$ ], and memory [CVLT Discrimination:  $t(116)=2.05, p=.04$ ], despite there being no significant differences between the SELP genotype groups on demographic and medical variables and CRP levels.

**Conclusions:** Contrary to expectations, the present analyses showed that older CVD patients with the SELP 1087A allele performed more poorly on several neuropsychological tests. Though findings from the present study were counter to previous research with CABG candidates, further work using neuroimaging and alternative measures of cardiovascular function is needed to clarify the mechanisms of this association. Correspondence: *Andreana Benitez, M.A., Psychology, Kent State University, P.O. Box 5190, Kent, OH 44242. E-mail: abenitez@kent.edu*

**L. BERNARDIN. Alexander Disease: a Rare Look at the Natural Evolution and Neuropsychological Progression from Infancy to Adulthood.**

**Objective:** This unique case presentation on the neuropsychological features of Alexander disease serves to expand our knowledge of the cognitive/behavioral affects of this rare genetic leukodystrophy. To date, only 111 genetically-confirmed cases have been published since the culpable gene GFAP was identified. None of these published cases include comprehensive, sequential neuropsychological data.

WITHDRAWN

**Participants and Methods:** Presented here is the case of a 20-year-old gentleman with a progressive leukoencephalopathy only recently identified as Alexander disease. Symptom history is described from infancy to adulthood. The results of neuropsychological testing from 2003, 2005, and 2008 are presented, along with year-by-year descriptions of behavioral and academic changes noted in school records. Results of neuro-imaging from 1997 to 2008 are also described.

**Results:** Earliest neurological symptoms, which appeared around age 7, were bulbar (nasal speech, eating difficulties). School records at that time note subtle changes in concentration, follow-through, and social behavior. Repeat neuropsychological evaluations show slowly progressive, global cognitive impairment punctuated by executive dysfunction. Insidious decline in academic performance parallels the neuropsychological findings. MRI scans show extensive changes to the cerebral white matter and subcortical structures in a pattern now recognized as unique to Alexander disease. Discussion includes comparison of the clinical/behavioral/neuroimaging features of this disorder to other known leukodystrophies.

**Conclusions:** This case serves to expand our understanding of cognitive and clinical features of Alexander disease by offering a unique look at the neuropsychological/behavioral progression of the disorder from infancy to early adulthood.

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D.Q. BEVERSDORF, A.L. CARPENTER, M.R. TILLEY, D.J. BIRMIINGHAM, J.K. ALEXANDER, A. HILLIER, N.T. JENKINS, R.M. SMITH, C.A. WHITE & H.H. GU. **Serotonin transporter genotype determines the effect of psychosocial stress on cognitive performance.**

**Objective:** Previous research has demonstrated an effect of various psychosocial stressors such as the Trier Social Stress Test on unconstrained cognitive flexibility. This impairment is reversed by propranolol, which suggests that the effect is noradrenergically mediated. However, polymorphisms in a number of genes have demonstrated effects on stress response. Presence of the short allele (S-allele, lacking a 43 base pair repeat) of the promoter region of the gene for the serotonin transporter protein (5-HTT) is associated with a greater amygdalar response to emotional stimuli on fMRI and a greater risk of depression after stressors. Therefore, we wished to determine whether presence of the S-allele is associated with a greater effect of stress on cognition.

**Participants and Methods:** Twenty eight healthy young adults without any history of an anxiety disorder were asked to solve anagrams during the Trier Social Stress Test, a public-speaking and mental arithmetic stressor, and during a similar but nonstressful control task. Order of sessions was counterbalanced. Participants were also genotyped for presence of the S-allele of the 5-HTT gene. Cognitive response to stress was compared across genotypes.

**Results:** A significant interaction effect was detected on anagram performance with a 2x2 (stress vs no stress, S-allele vs no S-allele) ANOVA. T-tests revealed that participants with the S-allele were significantly impaired during the stress condition, whereas those with no S-allele demonstrated no cognitive impairment during stress.

**Conclusions:** 5-HTT genotype significantly affects the cognitive response to stress. This may have significant implications for conditions associated with increased stress response, including performance anxiety and cocaine withdrawal.

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C.S. BLOSS, C. RODDEY, E.N. SMITH, A.H. JOYNER, T.E. BAKKEN, N.J. SCHORK, L.M. RIMOL, S. DJUROVIC, I. MELLE, I. AGARTZ, O.A. ANDREASSEN & A.M. DALE. **Genetic Variation in LRRK2 and Association with Frontal and Subcortical Brain Structure in Normal Aging, Schizophrenia, and Bipolar Disorder.**

**Objective:** Leucine-rich repeat kinase 2 (LRRK2), a putative susceptibility gene for Parkinson's disease, is known to be expressed in dopamine

target areas of the frontal cortex and basal ganglia. This raises the possibility that genetic variation in LRRK2 may influence brain structure in these regions in both normal aging and other dopamine-related disorders. Therefore, we investigated possible associations between polymorphisms in LRRK2 and neuroimaging-derived measures of cortical and subcortical brain structure in healthy adults and individuals with psychotic disorders.

**Participants and Methods:** Participants were enrolled in the Thematic Organized Psychoses Research Study (TOP) and included adult Norwegian men and women with normal aging (controls; n=119), schizophrenia (n=85), bipolar disorder (n=81), or other psychotic disorder (n=39). Subjects underwent neurocognitive and structural neuroimaging assessment and were genotyped on the Affymetrix Genome-Wide SNP 6.0 Array. Single nucleotide polymorphisms (SNPs; ~140) at the LRRK2 locus were tested for association with volumetric, area, and thickness measurements using linear regression and controlling for age, diagnosis, and gender.

**Results:** Primary analyses that included controls and individuals with psychotic disorders revealed evidence of association between rs2248928 and brain volume, cortical area, frontal cortical area, and cerebellar volume; SNPs rs11175456 and rs11564157 were associated with basal ganglia volume (all p-values < 4x10<sup>-4</sup>). Subgroup analyses comparing controls to schizophrenia and bipolar disorder subjects, respectively, showed generally consistent results. Evidence of differential SNP effects depending on diagnosis was observed for some SNPs.

**Conclusions:** Findings suggest that brain structural changes associated with LRRK2 may be one of the mechanisms through which this gene may mediate susceptibility to dopamine-related neurodegenerative disease.

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C.S. BLOSS, E.N. SMITH, C. NIEVERGELT, N.J. SCHORK, J.R. KELSEY & .. **THE BIPOLAR GENOME STUDY (BIGS) CONSORTIUM. Scanning the Genome for Genetic Susceptibility to Neuropsychiatric Disease: Genome-Wide Association of Bipolar Disorder.**

**Objective:** Bipolar disorder (BD), characterized clinically by alternating episodes of depression and mania, has further been associated with notable neurocognitive (e.g., executive dysfunction), as well as functional deficits. Family, twin, linkage, and candidate gene studies all suggest a strong genetic component in BD, although previous genome-wide association (GWA) studies, which to date have been limited to individuals of European Ancestry (EA), have generally failed to detect associations that have been replicated consistently.

**Participants and Methods:** We performed two GWA studies, one in a sample of individuals of EA (n = 1,001 cases; 1,033 controls) and a second in a sample of individuals of African Ancestry (AA; n = 345 cases; n = 670 controls). Participants were genotyped with the Affymetrix Genome-Wide SNP 6.0 Array, and after adjustment for admixture, association was tested under allelic and genotypic models.

**Results:** Although no single SNP showed significant association after correction for genome-wide testing, several nominal associations were observed. Among individuals of EA, evidence for association was observed with 10 SNPs in the Nck-associated protein 5 (NAP5) gene; among individuals of AA, association with 4 SNPs in the sortilin-related receptor (SORL1) was observed (all p-values < 5x10<sup>-5</sup>). From previous work, both genes show evidence of expression in several human tissues including brain.

**Conclusions:** Findings suggest that the genetic variations that contribute to BD may vary as a function of ancestry. Consistency of these results with other ongoing GWA studies of BD will be discussed, as will issues in the use of GWA techniques to study brain-behavior relationships and neuropsychiatric disease.

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**J. KATZENSTEIN, J. OGHALAI, R. TONINI, J. HAYMOND & S. CAUDLE. Comparisons Among Children with Hearing Loss Secondary to a Genetic Syndrome.**

**Objective:** Many childhood genetic syndromes result in hearing loss in young children, including Pendred, Usher, and Waardenburg syndromes. Recently, some children have received a cochlear implant (CI) to increase their auditory sensory input. However, little is known about the cognitive functioning of these children pre- and post-implant.

**Participants and Methods:** As part of a larger clinical cohort, children with pre-lingual severe to profound sensorineural hearing loss participated in neuropsychological testing 6-8 months prior to receiving a cochlear implant and some received follow-up approximately 12-months after activation of their implant. Children's diagnoses were confirmed by genetic testing. On average children were 24.38 months of age at their first testing (SD = 8.02 mos). In total, 8 children were studied (2 children with Pendred, 3 with Usher, and 3 with Waardenburg). All children received the Mullen Scales of Early Learning (MSEL) pre-implant and the Leiter International Performance Scales – Revised (Leiter) was administered post-implant.

**Results:** The Visual Reception (VR) subtest from the MSEL has been found to correlate very highly with the Full IQ from the Leiter-R in a hearing impaired population (in preparation). On average, children received a mean VR T-score of 35.38 (SD = 10.98) and an Early Learning Composite of 60.87 (SD = 5.64). Those who received follow-up testing achieved a mean Leiter Full IQ standard score of 119.50 (SD = 4.95).

**Conclusions:** Although direct comparisons cannot be made, these results suggest significant improvement in overall nonverbal intellectual functioning across the two time points and suggest that CI provides considerable cognitive benefit for these children. Further research should investigate a larger sample size longitudinally.

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**X. LI, J. SUNDQUIST & K. SUNDQUIST. Familial Risks for Anxiety Among Siblings Based on Hospitalizations in Sweden.**

**Objective:** Familial risks of anxiety have been assessed in small case-control studies, usually based on reported, but not medically verified anxiety in family members; thus the degree of familial clustering for these disorders remains to be established. This study used nationwide hospital records to examine sibling risk of any types of anxiety in Sweden over a 32-year period.

**Participants and Methods:** This 1 January 1972 to 31 December 2004 study of the entire population of Sweden linked information on family relationships from the nationwide Multi-Generation Register with information from the nationwide Swedish Hospital Discharge Register on first diagnoses of anxiety. Standardized incidence ratios (SIRs) were calculated by comparing risk in siblings of persons hospitalized for anxiety with risk in persons whose sibling had no hospital diagnosis of anxiety.

**Results:** The sibling risk was 3.02, which was independent of gender and age differences between siblings. The SIR was highest in siblings < 20 years of age (3.99). Analysis of subtype risk showed that having a sibling diagnosed with any anxiety disorder resulted in increased risk of a number of disorders; highest increased risk was of social phobias (SIR 4.70, 95% CI, 1.96-11.0). Risk of panic disorder, generalized anxiety disorder, and mixed anxiety and depressive disorders was raised in female but not male siblings.

**Conclusions:** Heritable effects likely play an important role in the etiology of anxiety disorders, but the extent of their role remains to be established. Important contributions could be made by studies of gene-environment interactions that have sufficient sample sizes to produce reliable results.

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**D.J. MARCUS, K.B. WHIGHAM & K. O'TOOLE. Investigating the Neuropsychological Outcomes of Pediatric Mitochondrial Disorders within a Neurodevelopmental Framework.**

**Objective:** To investigate and describe the neuropsychological profiles of children diagnosed with mitochondrial cytopathy, Complex I within a neurodevelopmental framework (Dennis, 2000).

**Participants and Methods:** This poster presents a case series of three children with mitochondrial cytopathy, Complex I. Participant 1 is a 6-year-old male with autistic features. Participant 2 is a 10-year-old female with comorbid movement disorder. Participant 3 is a 5-year-old male with accompanying hypotonia and accommodative esotropia. All three received neuropsychological evaluations as outpatients at a pediatric medical center.

**Results:** Cognitive abilities were variable across the three participants, with Participant 1 having significant developmental delays and autistic features, Participant 2 having a variable profile favoring verbal over nonverbal abilities, and Participant 3 also demonstrating a variable profile, but with better nonverbal than verbal abilities. Motor skill deficits were common in all three participants. All three families were educated about this disorder and were coping adequately, but had complaints regarding the school's lack of understanding of the disorder and insufficient services.

**Conclusions:** It is important to understand that there are many variations in the expression of mitochondrial disease, even within a specific cytopathy. This variability must be understood through a neurodevelopmental framework that takes into account the specific biological insult, as well as moderating factors such as development, time since symptom onset, and cognitive reserve. This approach is necessary in order to make appropriate recommendations and educate the family members and service providers associated with the child.

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**P. MATTIS, T. FLANAGAN, M. CARBON-CORRELL, S. BRESSMAN & D. EIDELBERG. Neuropsychological Functioning in Patients with Dystonia and Non-manifesting Carriers of the DYT1 and DYT6 genes.**

**Objective:** Although dystonia is often believed to be a purely motor disorder, we have previously documented deficiencies in sequence learning using psychophysical techniques, as well as abnormalities in metabolic brain networks using PET, in gene carriers of the most common primary dystonia (DYT1, 9q34; Ghilardi et al., 2003). The current study was designed to further delineate cognitive functioning in patients with primary dystonia utilizing more traditional neuropsychological instruments.

**Participants and Methods:** A series of neuropsychological instruments was examined in two groups of patient who carry a gene for dystonia (DYT1 or DYT6; 8p21-22), and either manifested (man) or do not manifest (nm) motor symptoms. We studied eight manDYT1, six nmDYT1, five manDYT6, and three nmDYT6 subjects, and 13 control subjects (NC).

**Results:** We found manDYT1 subjects did perform worse on the Symbol Digit Modality Test ( $t=-2.5$ ;  $p=0.02$ ) and Rey figure copy ( $t=-2.4$ ;  $p=0.04$ ) than did NC. However, there were no differences between nmDYT1 patients or DYT6 subjects (man and nm) and NC.

**Conclusions:** The current findings are consistent with prior studies indicating that patients with dystonia do not exhibit dramatic cognitive deficits; although the possibility of graphomotor difficulties is raised. Unlike our prior finding, clinical neuropsychological instruments did not differentiate nmDYT1 subjects from NC. Although the current findings need to be verified in a more robust sample, the current study suggests that the deficit in sequence learning found in the carriers of the DYT1 gene is specific to the neural networks effected by DYT1 and does not represent a more generalized cognitive impairment.

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**M. MCNALLY, C.F. SALORIO, G. BIBAT & S. NAIDU. Cognitive and Adaptive Functioning in the Common MeCP2 Mutations in Rett Syndrome.**

**Objective:** Rett Syndrome (RTT) is a neurodevelopmental disorder due to mutations in *methyl-CpG-binding protein 2* (MeCP2). It is characterized by loss of language and hand use. Recently, molecular analyses have identified common mutations. This study sought to identify cognitive and adaptive functioning differences across common mutations in girls with RTT.



**Participants and Methods:** This cross-sectional study identified 64 female RTT patients with known mutations (ages 2 to 14.9, median 6.8). Parents filled out Vinland questionnaires and neuropsychologists administered the Mullen Scales to evaluate cognitive and adaptive skills. ANOVAs were performed to evaluate overall group differences (by mutation type) across outcomes. Post-hoc analyses using Tukey tests examined variables with significant group differences ( $p < 0.05$ ).

**Results:** Significant group differences were found on the Vinland in communication, daily living, socialization, and motor skills (all  $p < 0.001$ ), and on the Mullen in gross motor, fine motor, and expressive language (all  $p < 0.05$ ). Post-hoc analysis indicated that R133C mutation was less severely impaired than most other mutations across all Vinland outcomes, and in gross motor and expressive language on the Mullen. Of note, the R294X mutation was not significantly lower than the R133C on any of the outcome variables.

**Conclusions:** This study demonstrates that functional impairment in girls with RTT varies among MeCP2 mutations, with R133C patients <15 years of age showing better functioning than all but the R294X mutation group. Longitudinal studies are underway to examine stability of mutation phenotype with age among these common mutations. Such relationships are important when counseling families and designing intervention programs.

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**M. STANCIL, C. SANCHEZ, J. SCHATZ & C.W. ROBERTS. Preterm birth and language development in young children with sickle cell disease.**

**Objective:** Sickle cell disease (SCD) is associated with a constellation of neurologic risks that may impact language abilities. Most studies have not considered the added impact of one of these neurologic factors, preterm birth, on child outcomes. We hypothesized that SCD and preterm birth might interact to affect child outcomes.

**Participants and Methods:** We assessed disease subtype, preterm birth, and social-environmental factors in relation to functional language skills in young children with SCD. A cross-sectional sample of 102 children from ages one to eight years with SCD were assessed for functional language skills, disease severity, birth history, caregiver functioning, and family environment.

**Results:** More severe sickle cell subtypes showed a linear decline in age-adjusted scores for language competence, whereas less severe subtypes showed no age-related change in language outcomes. Higher-risk sickle cell subtypes were related to lower levels of functional language skills, supporting the validity of this assessment tool for our purposes. Recent pain history, caregiver functioning and family environment were unrelated to outcomes. Disease subtype and birth history interacted such that children with high-risk subtypes that were born premature showed lower language competence than predicted from either condition alone.

**Conclusions:** Preterm birth appears to interact with disease severity in creating poorer functional outcomes in sickle cell disease. The combination of preterm birth and a more severe sickle cell subtype likely warrants careful tracking of the child's developmental status. The mechanism(s) for this synergistic interaction require further investigation.

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**K.M. SCHIABOR, C.S. BLOSS, O. LIBIGER, A.H. JOYNER, A.W. BERGEN, P.J. MAGISTRETTI, W.H. KAYE, N.J. SCHORK & .. THE PRICE FOUNDATION COLLABORATIVE GROUP. Large Scale Candidate Gene Association of Personality Profiles in Healthy Women and Women with Eating Disorders.**

**Objective:** Prior personality genetics studies have focused almost exclusively on circumscribed aspects of personality (e.g., novelty seeking) and associations with single nucleotide polymorphisms (SNPs) in specific candidate genes (e.g., DRD4). Alternatively, in the current study,

we utilized a novel statistical method to test for association between ~5,000 candidate SNPs and personality profiles among control women (CW) and women with an eating disorder (ED). This study represents a secondary analysis of a dataset collected primarily to evaluate candidate genes that may play a role in the genetic susceptibility to eating disorders.

**Participants and Methods:** Participants ( $n = 658$  CW;  $n = 1,058$  ED) were women enrolled in the Price Foundation Collaborative Study of Anorexia and Bulimia Nervosa. Participants were administered the Temperament and Character Inventory (TCI) and genotyped for ~5,000 SNPs in ~200 candidate genes. Within each group (i.e., CW and ED), multivariate distance matrix regression was used to examine the extent to which similarity in personality profiles, as measured by the 25 TCI sub-domains, was associated with each SNP.

**Results:** Results revealed different associations for CW and ED. Prominent associations (all  $p < 0.005$ ) with personality profiles among CW included SNPs in CCK, KCNN3, and ESR2. Among ED, profiles were associated with SNPs in HCRTR2, GABRG3, and CRHR2.

**Conclusions:** Findings suggest that profile-based phenotypes may provide a meaningful alternative to the use of single measures in genetic association studies of complex traits. Results also suggest novel genes and candidate pathways for further study in relation to the etiology of eating disorders, brain-behavior relationships, and neuropsychiatric disease.

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**B.J. STIEHLER, D. GERSTORF, S.L. WILLIS & K. SCHAIE. Cognitive Deficits in Memory for a Middle-Aged Sample of Apolipoprotein E (APOE) ε44 Individuals: Findings from the Seattle Longitudinal Study.**

**Objective:** The Apolipoprotein E (APOE) ε4 allele is a well-known leading risk factor for cognitive impairments in old age. Previous research has established that the presence of a single APOE ε4 allele links to cognitive deficits, but less is known about possibly cumulative risks for two APOE ε4 alleles (i.e., homozygous ε44). Furthermore, few studies have examined if individuals with such genetic risks may already show cognitive deficits in middle age.

**Participants and Methods:** To address these questions, we examined if and how single ε4 carriers ( $n = 104$ ), homozygous ε44 individuals ( $n = 13$ ), and non-carriers ( $n = 325$ ) selected from a middle-aged sub-sample (45-68 years) of the Seattle Longitudinal Study show differences in indicators of memory ability.

**Results:** Multi-group comparisons controlling for age, gender, and education indicated that homozygous ε44 individuals performed lower in both immediate and delayed recall as compared with single ε4 allele carriers and non-carriers. Follow-up analyses will also examine group differences in primacy and recency serial position for immediate and delayed recall measures.

**Conclusions:** These findings illustrate that APOE ε4 may be contributing to cognitive deficits earlier than typically thought, and homozygous ε44 individuals are at the greatest risk for these deficits.

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**D. WAHLSTROM, T. WHITE, P.F. COLLINS, D. IRONS & M. LUCIANA. Advantageous Decision-Making on the Basis of Prior Experience: Modulation by the DRD2 Taq1A Allele in Healthy Adolescents.**

**Objective:** The Taq1A D2 dopamine receptor (DRD2) A1 allele has been associated with substance use problems and gambling behavior in adults. Whether it modulates these problem behaviors in adolescents or whether it confers vulnerability to problem behaviors in healthy adolescents has not been addressed. In this study, healthy adolescents' performance on the Iowa Gambling Task (IGT), a measure of reward-related decision-making, was examined in relation to genotype.

**Participants and Methods:** Healthy adolescents and young adults ( $n = 103$ ) ages 9-23 completed the IGT, as well as measures of intellectual functioning and personality. Performance was examined using conventional methods of comparing advantageous choices over time, as well as a new scoring method developed in our lab that examines individually determined learning patterns across the task.

**Results:** The presence of the A1 allele was associated with fewer advantageous choices overall. In addition, it was related to an inability to adjust behavior based on the experience of task contingencies, as carriers of the A1 allele were unable to transition to more advantageous behavior even after reaching a point in the task where they experienced the reward and punishment contingencies of each deck. Conversely, individuals without the A1 allele improved their performance after fully experiencing the deck contingencies, and this pattern was maintained after controlling for age and full-scale IQ. Regression analyses also indicated that personality and the A1 allele predicted IGT performance in addition to age.

**Conclusions:** Findings are discussed in relation to individual differences and their neurobiological underpinnings that contribute to adolescents' vulnerability to risk-taking behaviors.

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#### K.M. YOUNG, T.M. LEVINE, T.B. GOGOLINSKI & L.E. CUTTING. Visuospatial Weaknesses in Children with Neurofibromatosis Type 1 (NF-1).

**Objective:** NF-1 is a genetic disorder characterized by visuospatial impairment and high incidence of learning disabilities, including reading disabilities (RD). In the general population, idiopathic RD (I-RD) is characterized by word recognition and phonological processing weaknesses; visuospatial strengths have also been reported. Although visuospatial impairment is reported in NF-1, assessment is often limited to the Judgment of Line Orientation (JLO) test.

**Participants and Methods:** To further understand the breadth and specificity of visuospatial impairment in NF-1, we compared 16 children with NF-1 to Controls ( $N=22$ ) and children with learning disabilities (I-RD;  $N=19$ ) on a battery of visuospatial tasks including the JLO, Visual Closure (VC), Position in Space (PS), Active Matrix Task (AMT) and mental rotation of letters (MRL).

**Results:** The NF-1 group performed lower than both the I-RD and Control groups on most of the visuospatial tasks (JLO, VC, PS, and MRL; all  $p < .006$ ). While the Control group outperformed the I-RD and NF-1 groups on the AMT, statistical significance was reached only for the Control and NF-1 group comparison ( $p < .007$ ); the AMT has language and working memory components (following oral directions regarding directional orientation), which may have adversely affected the I-RD group's performance.

**Conclusions:** Overall, findings suggest that visuospatial deficits in NF-1 are present on a variety of tasks and converge with the findings of JLO impairment; furthermore, these deficits appear to be specific to NF-1. Further exploration is ongoing, with an emphasis on potential relationships in NF-1 between visuospatial functioning and other areas of cognition (e.g. attention, executive function, language).

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#### Learning Disabilities/Academic Skills

##### R.L. ERICKSON, L.K. PAUL & W.S. BROWN. CVLT-II List Learning in Agenesis of the Corpus Callosum.

**Objective:** Agenesis of the Corpus Callosum (AgCC) results in impaired functioning on complex and novel cognitive and psychosocial tasks. The extent to which verbal learning and memory contribute to these deficits

is uncertain. A previous study using the Wechsler Memory Scale and a smaller group of individuals with AgCC found deficiencies only in immediate memory for paired associates. This research used the California Verbal Learning Test (CVLT-II) to study list learning in a larger group of participants with AgCC.

**Participants and Methods:** Sixteen individuals with AgCC (FSIQ  $> 80$ ) were given the CVLT-II. It was hypothesized that this group would score significantly below normal for trial 1-5 learning and total learning. It was also hypothesized that they would score significantly low on utilization of semantic clustering and significantly above average on utilization of serial clustering.

**Results:** Mean T-scores for total words recalled (trials 1-5) for these individuals with AgCC were significantly below normative levels ( $p < .05$ ). In addition, group mean standard scores were significantly below normal ( $z = 0.0$ ) for trial 1 ( $p < .02$ ), trial 3 ( $p < .01$ ), and trial 5 ( $p < .05$ ). No differences were found on any of the learning characteristic variables.

**Conclusions:** These findings suggest that individuals with AgCC have difficulty in list learning (i.e., encoding or integrating verbal information), but are typical in their use of semantic and serial clustering. These difficulties in learning may be related either to diminished access to right hemisphere encoding of information, and/or reduced ability to utilize interhemispherically integrated cortical processing networks.

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#### Other

##### C.R. ANDERSON, B.A. PARMENTER, C. BARBOSA-LEIKER, A.J. MILLER, T.S. FRESON & B.R. WRIGHT. The Influence of Cytokines on Cognition in a Young, Healthy Population.

**Objective:** The influence of inflammatory processes on cognition has been examined in a number of diseased and aged populations. The goal of this study was to examine whether pro-inflammatory (IL-1b, IL-6, and TNF $\alpha$ ) as well as anti-inflammatory (IL-10 and IL-4) cytokines predict cognitive functioning in a young, healthy population.

**Participants and Methods:** Cytokine serum levels were measured on 71 participants (age:  $M = 20.25$ ,  $SD = .44$ ) who also completed the n-back task, an experimental measure of working memory and processing speed. Working memory was measured by total correct (TC) on the 1- and 2-back. Simple processing speed was measured as mean reaction time (RT) on the 0-back and complex processing speed was measured as mean RT on the 1-, and 2-back.

**Results:** When all cytokines were entered, regression analyses revealed an overall significant model for RT on the 0-back ( $p = .02$ ,  $R\text{-squared} = .176$ ), with IL-6 and IL-4 emerging as significant predictors ( $\beta = 1.002$ ,  $p = .001$  and  $\beta = -.808$ ,  $p = .005$ , respectively). Analyses also revealed a model that approached significance for RT on the 1-back ( $p = .08$ ,  $R\text{-squared} = .158$ ) with IL-6 and IL-4 again emerging as significant predictors ( $\beta = 3.218$ ,  $p = .002$  and  $\beta = -2.639$ ,  $p = .01$ , respectively). Cytokine levels did not significantly predict RT on the 2-back or TC on the 0-, 1- or 2-back.

**Conclusions:** These results suggest that cytokine levels may predict differences in processing speed, but do not predict working memory performance in a young, healthy population.

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##### E. ARETOULI, M.H. KOSMIDIS, P. IOANNIDIS, D. KARACOSTAS & N. TASKOS. Insights into the Relationship of Theory of Mind and Executive Functioning: Evidence from Patients with Frontotemporal Dementia.

**Objective:** A great number of studies have investigated the relationship between 'theory of mind' (ToM) and executive functioning (EF) resulting in controversial findings. Although the majority of research in

this domain was conducted with children or individuals with neurodevelopmental disorders, recent investigations have begun to focus on adults and older individuals as well as on psychiatric and neurological conditions. We explored the relationship of ToM and EF in frontal variant frontotemporal dementia (fv-FTD), a neurodegenerative disease with prominent acquired executive dysfunction and theory of mind impairment.

**Participants and Methods:** We administered a series of tasks assessing aspects of ToM (both 1st order and 2nd order) and tasks assessing several EF domains, such as planning and concept formation, inhibition and spontaneous and reactive mental flexibility. Participants were 21 patients diagnosed as having fv-FTD at the early stages and an age- and education-matched control group.

**Results:** Significant relationships between ToM and EF were found. The fv-FTD performed worse than the controls on all conditions assessing ToM and most of the EF measures. Nevertheless, specific EF measures, particularly measures of spontaneous flexibility and inhibition, contributed significantly to the performance on ToM tasks. Moreover, after controlling for the effects of EF, the fv-FTD patients were found to have similar performance in one ToM condition with the normal controls.

**Conclusions:** Our results are indicative of a very strong link between ToM and EF, and suggest that EFs, particularly mental flexibility and inhibition, contribute significantly to the ability to assign mental states to others.

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#### **E.L. AUSTRIA, M.R. MEAGER, M. LACY & D. FRIM. Cognitive Deficits in Shunted Hydrocephalus Persist into Adulthood.**

**Objective:** Our previous research indicated that children with congenital hydrocephalus shunted within the first year of life displayed executive deficits, along with adaptive and behavioral difficulties (Lacy et al., 2008). In the current study we examined the neurocognitive status of a group of adults with a history of shunted hydrocephalus to assess if this pattern continues across the life span.

**Participants and Methods:** Twenty-four adults with a history of shunted hydrocephalus were administered a comprehensive neurocognitive battery of tests to assess current cognitive and emotional functioning.

**Results:** The average intellectual functioning of this group was in the average range WTAR FSIQ mean = 101.75 (SD=14.5). As documented in our child sample, adults with a history of shunted hydrocephalus displayed mild cognitive inefficiencies in attention and free recall RBANS Total=86.13 (SD=2.0). Closer inspection revealed a subset of patients (n=11) who were significantly impaired across all domains despite average premorbid IQ (WTAR =92.4 SD=14.0), and similar age (age =32.2 SD=14.6) and education (education =14.0 SD=3.8): RBANS Total of 70.9 (SD=12.4) vs. 100.1 (SD=14.7) [p=.000]. Adults with a childhood onset tended to have more profound impairments than those with later onset (p=.02).

**Conclusions:** Similar to the profile seen in our child sample, a sample of adults with a history of shunted hydrocephalus displayed mild executive inefficiencies. Closer inspection revealed a subset of patients who are experiencing gross cognitive impairment. Reasons for this impairment, including age of onset, depression, anxiety, etiology and previous shunting will be discussed with implications for adults at risk for cognitive impairment post shunting.

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#### **E.L. AUSTRIA, M. LACY & D. FRIM. Memory and Functional Independence in Childhood Hydrocephalus.**

**Objective:** A recent investigation of young adults with spina bifida meningomyelocele (SBM) found that memory skills were positively cor-

related with functional independence (Dennis et al, 2007). Prior investigations of a group of hydrocephalic children without SBM found deficits with verbal memory due to retrieval problems. The current investigation examined the relationship between memory deficits and functional independence in this group of hydrocephalic children.

**Participants and Methods:** Forty one children with a history of congenital hydrocephalus were administered the Rey Complex Figure and California Verbal Learning Test as part of a larger longitudinal study. Parents also completed the SIB-R. Pearson correlation analyses were conducted between memory and adaptive measures.

**Results:** Pearson correlations revealed the Broad Independence Index from the SIB-R to be positively correlated with the delay free recall performances from verbal and nonverbal measures: Rey Complex Figure Delayed Recall (p= .012); CVLT Long Delayed Free Recall (p= .002) and CVLT Discrimination Index (p= .002). The Support Index from the SIB-R was shown to correlate with the CVLT Long Delay Free Recall (p= .043).

**Conclusions:** The current investigation revealed a strong relationship between objective memory functioning and functional independence as assessed by parents. Specifically, children who display memory retrieval difficulties appear to be viewed by parents as less independent and requiring more support at home.

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#### **M.S. BANKS & K. O'TOOLE. Comparison Study of Two Teenage Athletes with Post-Concussion Syndrome: Can We Trust the Scans?**

**Objective:** This case study describes two teenage athletes with headaches subsequent to sports-related concussive events. Research on sports concussion highlights concern about subtle yet insidious problems across behavioral, attentional/executive, processing speed, and physical domains. The objective is to carefully examine how brain imaging contributes to understanding the outcomes of concussive events and to make concussion education recommendations for patients, families, teachers, and coaches.

**Participants and Methods:** Patient 1, an 18-year-old male had a history of multiple concussions five years prior to testing while Patient 2, a 16-year-old female, had a recent history of two practice-related incidents. Patient 1 retained normal scans over time whereas Patient 2, with only two concussions, continued to show abnormal hyperintensity in the margins of the right superior frontal sulcus 4 months post-event (scans provided).

**Results:** Results of neuropsychological testing for both patients showed intact intelligence and academic achievement with decreased processing speed and manual motor dexterity. Patient 1 is exhibiting significant executive dysfunction, memory deficiencies across modalities, decreased adaptive functioning, and abulia with a post-event history of emotional crisis. Patient 2 is not exhibiting any of these problems.

**Conclusions:** Research shows that athletes with a history of three or more concussions are three times as likely to experience another and that history of multiple concussions results in extended recovery period. Athletes often tend to under-report symptoms in order to return to play. Therefore, it is concerning that Patient 2 continues to be active in sports and may be on the same trajectory as Patient 1, particularly given the positive imaging findings.

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#### **L. EL-MESSIDI, P. CIRINO, J. FLETCHER & M. DENNIS. The Relation of Etiology and Shunting in Early Hydrocephalus: Effects on Cognitive Functioning.**

**Objective:** We examined variations in cognitive outcomes in relation to etiology (spina bifida, aqueductal stenosis) and shunting (shunted, arrested, no hydrocephalus).

**Participants and Methods:** The 420 school-age children (mean age = 11.5) were grouped as follows: spina bifida meningocele (SBM) and shunted hydrocephalus (n=270), aqueductal stenosis (AS) and shunted hydrocephalus (n=39), spina bifida (SB) with arrested hydrocephalus (n=21), spina bifida and no hydrocephalus (n=26), and normal controls (n=64). Each child was given a battery of neuropsychological and achievement tasks assessing verbal and nonverbal IQ, word identification, passage comprehension, calculation, visuomotor skills, concept formation and verbal skills.

**Results:** Children with AS performed in the average range except for visuomotor skills, with higher verbal (M= 98) and nonverbal scores (M= 98) in relation to SBM (M= 86/85), SB with arrested (M= 87/96) or no (M= 90/96) hydrocephalus. Children with SBM performed in the borderline to low average range across tasks and were particularly impaired in visuomotor skills (M< 70), calculations (M= 77) and concept formation (M= 81). Children with SB and no hydrocephalus performed in the average range across tasks but at lower levels than controls.

**Conclusions:** Children who present with SBM and shunted hydrocephalus exhibit the greatest impairment across cognitive skills. Children with AS and shunted hydrocephalus perform at higher levels than SBM. Those with arrested hydrocephalus show performance levels comparable to those with SB and no hydrocephalus but below controls. The results suggest etiology and shunting are critical factors in assessing outcomes in congenital hydrocephalus.

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#### **J.M. GAVEN, R. LICKLITER & L. GRAY. Bobwhite Hatchlings as Subjects for Developmental Psychoacoustics.**

**Objective:** Much work has been done on the responsiveness of Northern bobwhite quail (*Colinus virginianus*) to species-typical vocalizations, but less on traditional psychoacoustics. The purpose of this study was a signal-detection analysis of bobwhites' responsiveness to near-threshold pure tones.

**Participants and Methods:** Twenty-seven bobwhite hatchlings were individually tested between the ages of 1 and 36 days (mean number of tests = 14 with a range from 4 to 32 tests per bird). Some young birds peeped nearly incessantly when alone in the testing chamber, while others only began to peep after exposure to a recorded maternal assembly call. Once they began to peep, however, all subjects momentarily delayed their ongoing vocalizations when they heard a tone. Receiver-operating characteristics (ROCs) were constructed from the extent to which the birds stopped peeping on stimulus (tone) versus control (no tone) trials (>4000 trials total).

**Results:** Stable, increasing psychometric functions were constructed from the areas under these ROCs over a range of 21 dB and two frequencies (250 and 500 Hz). The number of birds that peeped sufficiently to finish the hearing test declined exponentially with age ( $r = 0.9$ ), and four of the 27 birds (~15%) continued to peep at 36 days of age.

**Conclusions:** The consistency of this unconditioned peep-suppression response presents the intriguing potential for future study of developmental psychoacoustics, as the hearing of bobwhite can be tested for a month or more after hatch using a consistent testing procedure.

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#### **J. GOLDSCHMIED, C. KNOEPKE, J.T. ARNETT & M. ALOIA. The Effects of Sleepiness in Obstructive Sleep Apnea.**

**Objective:** The aim of this study was to determine the degree to which excessive sleepiness in patients with Obstructive Sleep Apnea (OSA) contributed to cognitive performance and psychological complaints.

**Participants and Methods:** 97 newly diagnosed participants with OSA were recruited. Participants were administered a neuropsychological battery, including measures of mood, prior to treatment for OSA. The Epworth Sleepiness Scale (ESS) was used to assess sleepiness.

**Results:** Participants were chosen as sleepy (N=49) or non-sleepy (N=48) if they fell one standard deviation above or below the sample mean, respectively, on the ESS. Women were more likely to endorse excessive sleepiness than was expected ( $p < .05$ ). Also, sleepy participants had a higher body mass index, higher number of arousals from sleep during their polysomnographic study (PSG), and spent more time below 90% oxygenation during their PSG. These variables served as covariates in subsequent analyses. Composite cognitive variables were developed in the domains of vigilance, executive functioning, learning, memory, and motor functioning. Depression and apathy were also assessed. There were no significant differences on the cognitive variables, however we did find significant differences on both the BDI ( $p < .043$ ) and apathy ( $p < .003$ ), with the sleepy group performing more poorly.

**Conclusions:** Sleepy participants did not show relative decrements in cognition, despite the perception that they would. Depression and apathy were more prominent among sleepy participants. Findings may be due to method variance or true mood disturbance, but the lack of difference on objective measures of cognition is notable.

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#### **M. KORKMAN & S.L. KEMP. Effects of Gender in Normal Children on NEPSY-II Attention Subtest Scores.**

**Objective:** Attention deficit hyperactivity disorder (ADHD) is more common in boys than in girls. However, little is known about the effect of gender on attention in normal children. The goal of the study was to see if a gender effect can be seen on NEPSY II subtests designed for the assessment of attention, and if a possible gender effect interacts with age.

**Participants and Methods:** The sample consisted of 1160 children aged 3 to 16 years from the NEPSY II standardization sample. Dependent variables were the total scores of the Auditory Attention and Response Set subtest and the Inhibition subtest, analyzed for children aged 7 to 16 years (N = 763), and the Statue subtest, analyzed for children aged 3 to 6 years (N = 397). Gender and age effects were studied using univariate ANOVA.

**Results:** Weak but significant age effects ( $p < .05$ ) were seen on the Auditory Attention and Response Set subtest and the Statue subtest but not on the Inhibition subtest. The interaction of gender and age was not significant. The age effects were very significant.

**Conclusions:** An effect of gender was seen on two of three attention subtests. However, the differences were less prominent than that seen in the prevalence of ADHD in boys and girls. Thus, it seems that the greater tendency for boys to develop ADHD would not be entirely explained by a generally lower capacity for boys to attend.

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#### **M.C. LEVY & J.T. POYSKY. Behavioral Problems in Children with Duchenne Muscular Dystrophy and Parental Stress.**

**Objective:** Research has shown that boys with Duchenne muscular dystrophy (DMD) experience social skills deficits predictive of parental stress. These deficits may be partially linked to central nervous system involvement, which has been associated with cognitive deficits (Hinton, Nereo, Fee, & Cyrulnik, 2006). This study further investigates social skills and other deficits as well as child correlates of stress in parents of children with DMD.

**Participants and Methods:** Participants included 21 boys with DMD and their parents. Study participation occurred at time of child's medical follow-up. The Parental Stress Scale (PSS) and Behavior Assessment System for Children (BASC-2) assessed parental stress and child adaptive functioning/behavior problems.

**Results:** Parental stress was negatively correlated with child social skills and adaptive skills index, as well as positively correlated with child aggression (all  $p < .05$ ). In follow-up stepwise regression analyses, child social skills remained predictive of parental stress ( $p < .05$ ), whereas adaptability and leadership did not. T scores indicated boys with DMD were at risk for deficits in functional communication, activities of daily living, leadership, and working memory. Importantly, stage of illness was not correlated with these findings.

**Conclusions:** In keeping with past research, children with DMD are at risk for behavioral, adaptive, and cognitive deficits. While still unclear, some of these deficits may be related to central nervous system involvement implicated in DMD. Whereas deficits in social skills were predictive of parental stress, functional communication was not. Therefore, further identification of aspects of social skills deficits that predict parental stress is important for intervention (Hinton et al., 2006).

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**A.J. SPITTLE, J. LIM, K. TREYVAUD, L.W. DOYLE & P.J. ANDERSON. Behavioural Profiles of Infants Born Very Preterm.**

**Objective:** Children born very preterm have an increased frequency of behavioural problems at school age compared with their peers born at term. However, little is understood about behavioural problems in infancy for these children. The primary objective of this study was to compare behavioural profiles of very preterm infants at 2 years of age with peers born at term.

**Participants and Methods:** At 2 years corrected age, parents of 188 very preterm infants (gestational age <30 weeks or birthweight <1250 g) and 70 term infants completed the Infant Toddler Social and Emotional Assessment. Differences between very preterm and full term infants' behavioural profiles were examined using regression analysis.

**Results:** After controlling for social risk, at 2 years very preterm infants demonstrated significantly higher internalising (mean difference = 3.44; 95% CI 0.53 to 6.35) and dysregulation (mean difference = 4.39; 95% CI 1.29 to 7.49) scores, and lower competence scores (mean difference = -4.18; 95% CI -6.73 to -1.63) than term controls. No significant group differences were found for externalising behaviours. Compared with term controls, very preterm infants had increased depression/withdrawal and separation distress within the internalising domain, increased eating problems, negative emotionality and sensory sensitivity within the dysregulation domain, and reduced attention, imitation/pretend play, empathy, and mastery motivation within the competence domain. Males ( $p=0.024$ ), birthweight z scores ( $p=0.003$ ) and postnatal steroids ( $p=0.009$ ) were significantly associated with lower competence scores.

**Conclusions:** Being born very preterm is associated with problem behaviours including delayed competency at the age of 2 years.

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**J. LIM, K. HOWARD, G. ROBERTS, K. TREYVAUD, L.W. DOYLE & P.J. ANDERSON. Behavioural Manifestations of Executive Dysfunction in Children Born Very Preterm.**

**Objective:** Children born very preterm (<32 weeks' gestation) are at increased risk for neuropsychological deficits, including executive dysfunction (ED). While initial findings suggest that these children may display behavioural problems indicative of ED, the emergence and trajectory of these difficulties remain unknown. This study investigated behavioural manifestations of ED in very preterm children across early development.

**Participants and Methods:** This longitudinal study consisted of 144 very preterm children (56% male) born at the Royal Women's Hospital, Melbourne. At 2 and 5 years corrected age, parents completed the Behaviour Rating Inventory of Executive Function – Preschool Version. Consistency of diagnosis of problems on each of the 5 subscales (T or mean item raw score  $\geq 1.5$  SD) was assessed between 2 and 5 years using the kappa statistic.

**Results:** Very preterm children had the following rates of problems at 2 and 5 years, respectively, in inhibitory control (9.7%; 13.2%), shifting behaviour/attention (12.5%; 13.2%), emotional control (11.1%; 13.9%), working memory (12.7%; 31.0%), and planning/organisation

(11.8%; 22.9%). Diagnoses were significantly constant ( $p \leq 0.05$ ) between 2 and 5 years for all subscales except planning ( $p=0.196$ ). Changing classifications between 2 and 5 years were random for all but working memory ( $p=0.000$ ) and planning ( $p=0.014$ ), where significantly more children had problems at 5 years than at 2 years.

**Conclusions:** Behavioural difficulties indicative of ED can manifest as early as 2 years of age in children born very preterm. The proportion of children with clinically significant working memory and planning difficulties in executive function increases between ages 2 and 5 years.

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**S.M. MCMANUS & G.W. FONG. Neuropsychological Profile of a 7-year-old boy with Nephrogenic Diabetes Insipidus.**

**Objective:** Patients with diabetes insipidus (DI) lack the ability to concentrate urine adequately, resulting in large amounts of dilute urine being passed (Linshaw, 2007; Nabe et al., 2007). In nephrogenic diabetes insipidus (NDI), the kidney fails to respond adequately to normal or high serum concentrations of vasopressin even in the presence of severe dehydration and possible circulatory collapse (Linshaw, 2007). Mental retardation has largely been thought to be a common clinical correlate of NDI. However, while limited research on the neuropsychological profile of NDI is available, emerging evidence suggests that the prevalence of mental retardation among patients with NDI is lower than previously reported (Hoekstra et al., 1996).

**Participants and Methods:** The patient is a 7-year-old boy with a history of NDI and ADHD who was referred for a comprehensive neuropsychological evaluation. He was administered a battery that included tests of intellectual, executive, attention, motor, visuospatial, learning and memory, academic, and social/emotional functioning.

**Results:** Findings from the neuropsychological evaluation indicated average overall intellectual functioning. Assessment of focal cognitive domains indicated abilities broadly within normal limits, with the exception of impairments in attention and executive functioning.

**Conclusions:** This case study lends further support to recent findings that mental retardation is not necessarily a clinical hallmark of NDI. As suggested previously, improvements in the early detection of NDI and in the management of NDI likely contribute to this change in the cognitive outcomes of patients with NDI (Hoekstra et al., 1996).

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**S.M. MCMANUS & G.W. FONG. Neuropsychological Profile of a Series of Brothers with Familial Mitochondrial Disease.**

**Objective:** Mitochondrial diseases result from mutations in mitochondrial DNA (mtDNA) or nuclear DNA (Naviaux, 2000). The CNS is among the most frequently involved organs, but because mitochondria perform so many different functions in different tissues, significant variability exists (Finsterer, 2006). Because of the complex interaction between hundreds of genes and cells, it is the hallmark of mitochondrial diseases that even identical mtDNA mutations may not produce identical diseases (Naviaux, 2000). Such heterogeneity makes identifying a consistent neuropsychological profile difficult; existing literature suggests outcomes ranging from broad to focal cognitive deficits. While developmental delays or cognitive impairments have been reported in over half of two samples of children with mitochondrial disorders (Nissenkorn et al., 2000; Scaglia et al., 2005), other studies have begun to suggest that despite high mortality rates, those who survive have mild to no long-term cognitive impairments (Debray et al., 2007). However, limited neuropsychological studies are available. One study examined a family with mitochondrial cytopathy and reported intact intellectual abilities with executive dysfunction (Neargarder et al., 2007).

**Participants and Methods:** Two brothers (PM, age 7; SM, age 4) with familial mitochondrial disease completed comprehensive neuropsychological testing.

**Results:** Both brothers were found to be largely cognitively intact with the exception of varying degrees of attention and fine motor difficulties. In general, PM's deficits were more severe. While PM demonstrated strength in his verbal abilities, strength was noted in SM's nonverbal abilities.

**Conclusions:** These case studies lend further support to the notion that mitochondrial diseases do not always lead to long-term cognitive impairments.

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#### M.D. OLIVEIRA, R.E. HANLON & S. SWANTEK. Rhombencephalosynapsis: Neurocognition and Mood.

**Objective:** Rhombencephalosynapsis (RS) is a rare developmental disorder of the cerebellum, characterized by vermian agenesis/hypogenesis, as well as fusion of the dentate nuclei and cerebellar hemispheres. Historical documentation of this unusual condition is limited to only approximately 50 cases, with most reports implicating children. Cerebellar involvement in cognition and mood is a relatively recent notion that has been supported by cases in which patients with lesions confined to this region manifested deficits collectively referred to as the cerebellar cognitive affective syndrome. To our knowledge, only one previous report has described neuropsychological functioning in an adult patient diagnosed with RS, who also evidenced commonly related/compounding abnormalities on neuroimaging. The current report provides neurocognitive data on an RS patient with no associated anatomical anomalies and as such, this is the first known adult case in which neuropsychological and behavioral information can be directly linked to this rare malformation. Magnetic Resonance images are presented.

**Participants and Methods:** A 41-year-old man previously diagnosed with bipolar disorder and currently diagnosed with RS underwent a neuropsychological battery assessing general intellect and cognition.

**Results:** Generalized intellectual functioning was documented in the average range. His neuropsychological profile revealed mild attentional/executive dysfunction, and anterograde memory difficulty for verbal information. All other neurocognitive functions were preserved.

**Conclusions:** Given the absence of associated RS anomalies, the neurocognitive deficits and mood disturbance described in this case and others with this rare developmental disorder may be conceivably attributed to the hypothesized cerebellar cognitive affective syndrome.

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#### J. BAPP NEWMAN, A. GUSTAFSON-DE BASTOS, I.M. ZITRON, D. BATTON & S. RAZ. A Dose-Response Relationship Between Intrauterine Growth and Neuropsychological Outcome in the Very Preterm Infant.

**Objective:** We wished to test the hypothesis that a dose - response relationship exists between intrauterine growth and neurodevelopmental outcome, in preschoolers at risk from very premature birth.

**Participants and Methods:** Neuropsychological outcome data from 111 children (23 - 30 weeks gestation) were available. Seventeen cases had a history of suboptimal birthweight, defined as below the 15th centile when stratified by gestational age at delivery.

**Results:** As an index of intrauterine growth we used a z score expressing the deviation of an infant's birthweight from the mean weight of his/her gestational age group at delivery. Multivariate covariance analysis with SES, gestational age, sex, number of perinatal complications, and days on supplemental oxygen, used as covariates revealed a significant relationship between the index of intrauterine growth and the WPPSI-R Performance ( $F [1, 103] = 7.58, p < .01$ ), but not Verbal ( $F$

$[1, 103] = 3.01, p < .10$ ) IQ. Associations with the Auditory Comprehension, Expressive Communication, and Total Language Scales (PLS-3), and with Gross, Fine, and Total Motor Quotients (PDMS-2) were not significant. The relationships with the PIQ remained significant even following removal of all cases with birthweight below the 15th centile from the analyses ( $F [1, 86] = 8.24, p < .01$ ).

**Conclusions:** In this large sample of very preterm birth children, a continuous measure of intrauterine growth was found to have a dose-response relationship with visuo-perceptual skill development. Intrauterine growth assessed at delivery may thus be regarded as an indirect index of the fetus' brain integrity as impacted by genetic and environmental factors operating in-utero.

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#### S. ROY, N.W. PARK, S. LOMBARDI & D.A. GOLD. Tool Grasping for Use Requires Manipulation but not Function Tool Knowledge.

**Objective:** Two separable aspects of tool knowledge have been proposed: function (i.e., purpose of tool) and manipulation (i.e., how it is used). Patients with apraxia have been shown to have impaired manipulation, but not function, knowledge (Buxbaum & Saffran, 2002). Barde and colleagues (Barde, Buxbaum & Moll, 2007) have further proposed that two distinct action systems mediate knowledge about tool grasping: the prehensile system, which is activated when tools are grasped simply to move them (grasp-to-move), and the non-prehensile system, which is activated when tools are grasped appropriately for use (grasp-to-use). We investigated the hypothesis that manipulation, but not function, knowledge shares cognitive processes with grasp-to-use.

**Participants and Methods:** Undergraduates performed function and manipulation judgments under full and divided attention. In the secondary task, participants moved common tools (e.g., hammer) from one fixed location to another as quickly as possible. In Experiment 1, participants were explicitly instructed to grasp tools appropriately for use when moving them, whereas in Experiment 2, they were simply told to move the tools.

**Results:** Judgment performance was lower under divided compared to full attention conditions, and performance was more impaired when participants performed grasp-to-use with manipulation judgments than with function judgments,  $F(1, 29) = 4.95, p = .03, \eta^2 = .15$ . This interaction disappeared when participants performed judgments with grasp-to-move.

**Conclusions:** These results support our hypothesis that manipulation, but not function, tool knowledge and grasp-to-use share overlapping cognitive processes. Further, our findings provide converging evidence of dissociation between function and manipulation knowledge which has previously been shown in patients with apraxia.

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#### M. SPENCER-SMITH, V. ANDERSON, P. ANDERSON, R. JACOBS & L. COLEMAN. Childhood Brain Insult: An Earlier Age of Onset Predicts a Worse Outcome.

**Objective:** There is an assumption that the central nervous system (CNS) is more flexible during infancy and childhood than later in life, a property referred to as "plasticity". In the context of early brain insult (EBI), plasticity has traditionally been associated with superior functional recovery. This study aimed to evaluate the plasticity hypothesis by comparing functional outcomes for children with EBI sustained from gestation to late childhood.

**Participants and Methods:** The sample included 138 children grouped based on timing of EBI, represented by 6 groups: (1) Congenital (n=33): 1st-2nd trimester; (2) Peri-natal (n=25): 3rd trimester-1 month post-birth; (3) Infancy (n=19): 2 months-2 years; (4) Preschool (n=17): 3-6 years; (5) Middle childhood (n=28): 7-9 years; and (6) Late childhood (n=16): after age 10. Groups were similar with respect to brain insult characteristics. As expected, seizure history differed between the groups. Children were assessed for a range of attention skills.

**Results:** Results showed that children with EBI exhibited reduced attention. Children sustaining EBI before age 3 demonstrated global attention deficits, while children with later EBI performed closer to normal expectations. Children with EBI in middle childhood performed within age expectations on all aspects of attention assessed.

**Conclusions:** EBI is associated with increased risk for impairment in attention. There is a linear association between developmental timing of EBI and functional outcome, with earlier insult associated with poorest outcome. Middle childhood may represent a critical period when the developing brain is better able to compensate for injury.

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**M. SPITZNAGEL, J. GUNSTAD, J. UPDEGRAFF, T. COLLINSWORTH, K. PIERCE & E. GLICKMAN. The Effects of 53-hours Sleep Deprivation and Acute Cold Exposure on Cognitive Function.**

**Objective:** Past research demonstrates sleep restriction/deprivation impairs cognitive performance, particularly in measures of complex attention and executive function. Cold exposure also appears to impact cognitive performance, though no study has investigated the cognitive impact of both sleep deprivation and cold exposure combined.

**Participants and Methods:** Six healthy young adult males participated in a within-subjects design entailing two counter-balanced 53-hour protocols; one involving two-hour cold exposure (10 degrees C) blocks every 24 hours only, the other involving both the cold exposure condition as well as complete sleep deprivation for the duration of the 53 hours. Cognitive testing (IntegNeuro computerized cognitive test battery) was completed every 4 hours during the sleep deprivation plus cold exposure condition, and every 4 waking hours in the cold exposure alone condition.

**Results:** Generalized estimating equations indicated a linear effect of time for cold exposure and sleep deprivation in the following tasks: digit span ( $z = -3.48, p < .001$ ), choice reaction time ( $z = 3.41, p = .001$ ), verbal interference—word (stroop word) ( $z = -3.48, p < .001$ ), verbal interference—color/word ( $z = -2.62, p = .009$ ), and number of mazes completed ( $z = 2.32, p = .02$ ). No linear effect of time emerged in the cold exposure alone condition.

**Conclusions:** These findings suggest an interaction effect between sleep deprivation and cold exposure, with diminished performance on cognitive tasks over the course of time, though cold exposure over time alone did not impact cognitive performance. These findings are consistent with previous research suggesting attentional and executive impact of sleep deprivation. Further work is needed to clarify the physiological mechanisms for cognitive decline associated with sleep deprivation.

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**N.C. WALZ, S.L. WADE, L.A. BERNARD, M.A. STAAT & P.M. RYAN. Social Information Processing in Formerly Institutionalized Chinese and Eastern-European Adopted Girls.**

**Objective:** Some research suggests longer-term social problems in internationally adopted (IA) children with a history of institutionalization. Little research has focused on assessment of the social information processing (SIP) skills of adoptees or the relationship between SIP and neurobehavioral skills.

**Participants and Methods:** Adopted participants were girls between the ages of 6 - 10 years adopted from China ( $n = 16$ ) and Eastern Europe ( $n = 14$ ). These participants were institutionalized prior to adoption which occurred between the ages of 8 - 42 months. An age-matched control group of American born ( $n = 14$ ) girls also participated. Children completed an IQ screen and a measure of SIP. Mothers completed ratings of behavior problems, executive functioning, and social competence.

**Results:** Chinese girls tended to attribute more hostility to accidental or ambiguous social situations compared to controls ( $p = .11$ ). Fifty percent of the Eastern-European girls generated a hostile response to a so-

cial scenario compared to 18 % of controls ( $p = .08$ ). There was a trend for Eastern-European girls to evaluate aggressive responses less negatively ( $p = .14$ ). Within the group of 30 adopted girls, hostile response generation was correlated with more problems with executive functioning ( $r = .43, p = .02$ ) and poorer social competence ( $r = .50, p = .01$ ). Moreover, positive evaluation of competent responses was correlated with higher IQ ( $r = .38, p = .04$ ).

**Conclusions:** Findings provide preliminary support for the possibility of problems with specific SIP steps in formerly institutionalized IA girls. Findings also suggest a relationship between later SIP steps and specific neurobehavioral skills.

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**T.A. ZABEL, S. PAULOS, R. MARTIN, G. JALLO, E. AHN & M. JOHNSTON. Neuropsychological outcomes following acquired obstructive hydrocephalus and endoscopic third ventriculostomy: Three adolescent case reports.**

**Objective:** Studies of obstructive hydrocephalus (OH) typically involve clinical groups (i.e., Spina Bifida [SB], Dandy Walker Malformation [DWM]) with complex congenital brain malformations and early onset of OH, with little examination of OH acquired later in pediatric development. We report on the first three adolescents enrolled in our study of individuals with OH secondary to midbrain tumors presenting in early/mid adolescence.

**Participants and Methods:** In addition to tumor debulking, a minimally-invasive surgical technique (i.e., endoscopic third ventriculostomy [ETV]) was used to treat OH as an alternative to shunting. All three participants (ages 10, 14, and 16) underwent neuropsychological assessment at least one year post-ETV and presented with persistently enlarged ventricles on MRI despite a reduction in qualitative symptoms of OH (e.g., nausea, headache) and no evidence of transependymal edema.

**Results:** Neurocognitive findings were similar to those commonly described in patients with SB and DWM, with age-appropriate verbally-based skills (naming, repetition, comprehension, fluency, verbal reasoning) and deficits in most visual-spatial abilities assessed (discrimination, spatial relations, visual-motor integration, visual-reasoning). Both verbal and nonverbal learning and recall were deficient in all three participants, and academic fluency was low in two cases. Unlike reports of children with SB and DWM, parent report of executive (BRIEF) and adaptive (ABAS-II) functioning in these ETV-cases were within normal limits.

**Conclusions:** These findings suggest a possible disruption of neurocognitive functioning with preservation of functional/adaptive skills when OH is acquired in adolescence rather than during infancy. The potential functional implications of age at time of OH, surgical-correction procedures, and developmental context will be discussed.

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## TBI (Child)

**L.A. CHAPMAN, S.L. WADE, N.C. WALZ, H. TAYLOR, T. STANCIN & K.O. YEATES. Clinically Significant Behavior Problems During the Initial 12 Months Following Early Childhood TBI.**

**Objective:** The present study looked at the emergence of clinically significant problems in behavior, executive function skills (EF), and social competence during the initial 12 months following TBI in young children relative to a cohort of children with orthopedic injuries (OI).

**Participants and Methods:** Children, ages 3-7, hospitalized for moderate to severe TBI ( $N = 87$ ;  $M = 5.01$  yrs) or OI ( $N = 119$ ;  $M = 5.12$  yrs) were seen shortly after their injury ( $M = 40$  days) and again 6 months and 12-months postinjury. Behavioral parent self-reports (CBCL and BRIEF), demographic data, family functioning reports (LESRI: Relationship Stressors and FAD), and home environment report (HOME) were collected at injury baseline, six months, and twelve months postinjury.

**Results:** The groups did not differ on proportions exceeding the clinical cutoffs on the CBCL, BRIEF, or PKBS/HCSBS at baseline. Children in the severe or moderate TBI group had significantly higher rates of behavior problems and executive dysfunction at both 6 and 12 months postinjury relative to the OI comparison group. At any time postinjury, 57% of the severe TBI group, 41% of the moderate TBI group, and 24% of the OI group exceeded the sub clinical cutoff on one or more of the measures. Predictors of the emergence of clinically significant problems included pre-injury family functioning and stress, as well as the home environment.

**Conclusions:** Severe TBI adversely affected behaviors more than orthopedic injury in the long-term, and family/home environment at time of injury were important predictors of those behaviors.

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**W.R. COLE, S. PAULOS, C. TANKARD, C. SALORIO & B. SLOMINE. Impact of a Family Intervention for Adolescent Brain Injury on Behavior and Executive Functioning: Two Case Studies.**

**Objective:** Adolescents with acquired brain injuries (ABI) experience emotional, behavioral, and executive function difficulties. Research on family-based interventions for pediatric ABI suggests that appropriate adaptation of the family environment can aid in recovery of these difficulties. We developed a short-term, module-based family intervention for children with ABI. Data from two cases are presented.

**Participants and Methods:** Behavioral functioning was measured with the parent-report BASC-2 and executive functioning was measured with the parent-report BRIEF pre- and post-treatment. Reliable change indices were used to identify significant changes post-treatment. Case one is a 16-year old male with a severe traumatic brain injury. Case two is an 18-year old female post brain tumor resection.

**Results:** Case one: Pre-treatment report on the BASC-2 indicated clinical elevations in two scales, with post-treatment improvements on hyperactivity, anxiety, depression, and withdrawal scales and the internalizing problems and behavioral symptoms indices, and no scales clinically elevated. On the BRIEF, six scales/ indices were clinically elevated pre-treatment. Significant improvements post-treatment were noted for working memory, organization of materials, and monitor scales, with three scales no longer clinically elevated. Case two: No scales were clinically significant pre-treatment on the BASC-2, but improvements were reported on anxiety, withdrawal, and attention problems scales and behavioral symptoms index. Report on the BRIEF indicated pre-treatment clinical elevation in initiate, with significant improvements on initiate, working memory, and plan/ organize scales, and initiate no longer clinically elevated post-treatment.

**Conclusions:** These results suggest short-term family-based interventions are helpful in improving emotional, behavioral, and executive function problems post-ABI. Implications for future directions are discussed. Correspondence: *Wesley R. Cole, Ph.D., Neuropsychology, Kennedy Krieger Institute, 1750 Fairmount Ave., Baltimore, MD 21231. E-mail: colew@kennedykrieger.org*

**L. EWING-COBBS, M.R. PRASAD, L. KRAMER, P. SWANK, R. JENKINS, J.M. FLETCHER & K.M. HASAN. Traumatic Brain Injury and Developmental Changes in Limbic and Association Pathways: A Diffusion Tensor Imaging Study.**

**Objective:** Diffusion tensor magnetic resonance imaging (DTI) allows quantification of in vivo changes in the microstructure of white matter related to normal development and to pathologic processes. We examined the effect of traumatic brain injury (TBI) and age at scan on DTI metrics from regions-of-interest (ROIs) in limbic system and cortical association fibers.

**Participants and Methods:** DTI scans were obtained at 3.0T from children and adolescents with TBI (n=56) and in typically developing comparison children (n=51). ROIs were evaluated in the fornix, uncinate,

and cingulate and in the arcuate fasciculus, superior longitudinal fasciculus, and external capsule. DTI metrics included fractional anisotropy (FA), which reflects the integrity and degree of fiber organization; radial diffusivity, which assesses change associated with myelin; and axial diffusivity, which assesses axonal morphology and degradation.

**Results:** Group x Laterality x Age generalized linear models revealed no main effects for laterality and no interactions of the factors with any of the three DTI metrics. FA was lower and the radial diffusivity was increased in the TBI group in all regions (all  $p < 0.01$ ) except the external capsule; axial diffusion did not differ for any ROIs in the TBI and comparison groups. Age effects were noted for FA and the radial diffusivity in the arcuate and cingulate. The cortical association pathways and cingulate had decreased radial diffusion with increasing age.

**Conclusions:** TBI produces widespread changes to limbic and cortical association fibers characterized by reduced integrity of fiber pathways and alteration of myelin. Developmental changes were noted in all cortical association pathways and in the cingulate. R01 NS43608.

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**G.A. GIOIA, P. ISQUITH, J. SCHNEIDER, C. VAUGHAN, D. VINCENT, E. LEAFFER & L. OURANT. Clinical Validation of a Computer Administered Pediatric Cognitive Test Battery for Children with Mild TBI.**

**Objective:** Evaluate clinical validity of a computer administered cognitive test battery for children with concussion/ mild traumatic brain injury (mTBI)

**Participants and Methods:** 17 boys, 10 girls aged 5-12 years with concussions/ mTBI (Median days since injury = 9) were matched by age, sex and race/ethnicity to typically developing children. Participants were administered a computer-administered 7-subtest neurocognitive battery with 5 alternate forms. The pediatric version has previously demonstrated developmental trends in performance, minimal differences between boys and girls, appropriate internal consistency and test-retest reliability, and equivalence among alternate forms. Selected visual and verbal recognition memory and speed of processing subtests were analyzed: response accuracy, response time, RT variability calculated for each subtest.

**Results:** MANOVA's on related dependent variables within each subtest revealed slower and more variable response times across tasks overall. Specifically, the mTBI group was slower ( $\eta^2 = .10$ ) and more variable ( $\eta^2 = .09$ ) in their response speed on a processing speed/ reaction time task. On tasks of picture and design memory retrieval, the mTBI group was also significantly slower ( $\eta^2 = .08$ ,  $\eta^2 = .12$ ) and more variable ( $\eta^2 = .09$ ,  $\eta^2 = .08$ ) in their performance despite no differences in memory accuracy.

**Conclusions:** Selected subtests from a developmentally-appropriate computerized test battery were sensitive to slower and more variable response times on processing speed and memory retrieval tasks, characteristic of children with concussions/ mTBI. This study complements the normative development of this pediatric neurocognitive battery by adding the first evidence of validity for use with children with concussion/mTBI. Correspondence: *Gerard A. Gioia, Ph.D., Pediatric Neuropsychology, Children's National Medical Center, 14801 Physician's Lane, Suite 173, Rockville, DC 20850. E-mail: ggioia@cnmc.org*

**J. HAARBAUER-KRUPA. Traumatic Brain Injuries in Preschool Children: High Risk for Consequences and Disparities in Identification.**

**Objective:** Children who sustain a brain injury under the age of 5 are particularly vulnerable to the effects of diffuse brain injuries (Eiselle & Aram, 1993, Ewing-Cobbs, & Barnes, 2003; Ewing-Cobbs & Barnes, 2002, Lowenthal, 1998). Contrary to theories on neuroplasticity, a brain injury in preschool creates risks for developmental consequences across the lifespan. Injury effects may not appear until several years later when increased demands for processing and executive skills come into play.



Early identification and follow-up for young survivors of brain injury is critical; however, due to lack of a single point of entry to follow-up services and the latent nature of cognitive and behavioral symptoms, disparities in identification exist for this population. The goal of this paper is to describe disparities in identification of this population verified by an injury reporting system in the state of Georgia.

**Participants and Methods:** Emergency room visits for traumatic brain injuries in children under age 5 reported to the Georgia Central Registry were compared to children identified in preschool special education program counts.

**Results:** In 2004, the Central Registry captured 7922 visits to the emergency for children between the ages of 0-4 years. Of these children, 7763 were discharged home for care. In the same year, reports from preschool counts of TBI children enrolled in special education in the state identify 16 children with TBI a number which increased to 17 for 2005. These findings concur with a recent report on under-identification of school-aged children following TBI (Todis, 2007).

**Conclusions:** Disparities in accurate identification require procedures for capturing children who experience symptoms across healthcare, school and community settings.

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**C. HAJEK, K.O. YEATES, H.G. TAYLOR, B. BANGERT, A. DIETRICH, K. NUSS, J. RUSIN & M. WRIGHT. Parent-Child Agreement in Ratings of Post-concussive Symptoms Following Mild Traumatic Brain Injury.**

**Objective:** To investigate agreement between parent and child ratings of post-concussive symptoms (PCS) in children following mild traumatic brain injury (mTBI).

**Participants and Methods:** Children 8 to 15 years of age were recruited prospectively, and included 186 with mTBI and 99 with orthopedic injury (OI). To assess PCS, parents and children completed the PCS Interview (PCS-I) and the Health and Behavior Inventory (HBI) at 2 weeks, 1 month, 3 months and 12 months post-injury. Analyses examined agreement for individual items and scale composites, in terms of both means and individual differences.

**Results:** Correlations between child and parent ratings were significant but modest on both measures of PCS, in both groups. In the mTBI group, item-level correlations ranged from .00 to .40 on the PCS-I and from .02 to .41 on the HBI. In the OI group, correlations ranged from .01 to .56 on the PCS-I and from .03 to .49 on the HBI. Parent-child correlations for composite scales on the HBI were significant, but somewhat higher for cognitive symptoms as compared to somatic symptoms. Mean symptom ratings tended to be significantly higher for children as compared to parents. Repeated measures analyses for composite scales showed differences between raters to be consistent across time for somatic symptoms, but less consistent for cognitive symptoms.

**Conclusions:** Parents and children display modest agreement when reporting PCS; their ratings correlate significantly, but children report higher mean levels of symptoms than parents. Parents may underestimate children's experience of PCS, especially for somatic symptoms.

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**J.G. HALLDORSSON, K.M. FLEKKOY, G.B. ARNKESSON, K. TOMASSON, H.B. MAGNADOTTIR & E.O. ARNARSON. Pediatric Traumatic Head Injuries: The Prognostic Value of Injury Severity, Location of Traumatic Event, and Age at Injury Four Years Post-Injury.**

**Objective:** To estimate the prognostic value of injury severity, location of traumatic event, age, gender, and urban/rural residence, for symptoms of pediatric traumatic head injuries (THI) four years post-injury.

**Participants and Methods:** Data were collected prospectively from Reykjavik City Hospital on all patients age 0-19 years, diagnosed with THI during a one year period (n = 405). Information was collected on

patient demographics, location of traumatic event, cause of injury, injury severity, and diagnosis (ICD-9 850-854). Injury severity was estimated according to the Head Injury Severity Scale (HISS). Four years post-injury, a questionnaire on late symptoms attributed to the THI was sent to patients.

**Results:** Symptoms reported were more common among patients with moderate/severe THI than among others ( $p < 0.001$ ). The traumatic event location had prognostic value ( $p < 0.05$ ). Overall, 72% of patients with moderate/severe motor vehicle related THI reported symptoms. There was a curvilinear age effect ( $p < 0.05$ ). Symptoms reported were least frequent in the youngest age group, 0-4 years, and most frequent in the age group 5-14 years. Gender and urban/rural residence were not significantly related to symptoms.

**Conclusions:** Motor vehicle related moderate/severe THI resulted in a high rate of late symptoms. Location had a prognostic value. Patients with motor vehicle related THI require special consideration regardless of injury severity. Further research is needed on late sequelae of moderate/severe THI in the youngest age group, 0-4 years.

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**C.G. VAUGHAN, D.T. VINCENT, E. LEAFFER, J.C. SCHNEIDER, R.M. ROTH, P.K. ISQUITH & G.A. GIOIA. Clinical Utility of a Computer Administered Working Memory and Inhibitory Control Battery for Children with Concussion.**

**Objective:** We evaluated the utility of a novel test of working memory and inhibitory control for children with concussions.

**Participants and Methods:** 25 boys and 10 girls aged 9-18 years with concussions were matched by age, sex and race/ethnicity to typically developing children. All participants completed two alternate forms one week apart of a visual task that parametrically combines an N-back paradigm (0, 1, 2-back) to assess working memory with a go/no-go paradigm to assess inhibitory control.

**Results:** A repeated measures MANOVA comparing clinical vs control groups and first versus second administration revealed an overall main effect ( $p < .005$ ) with mTBI having slower response times ( $\eta^2 = .11$ ) and greater response time variability ( $\eta^2 = .12$ ) across all levels of working memory and inhibitory control. The mTBI group showed a normal pattern of decreased accuracy ( $\eta^2 = .58$ ) and increased variability ( $\eta^2 = .17$ ) with increased working memory load, and slower response time ( $\eta^2 = .12$ ) with the addition of the inhibit demand.

**Conclusions:** The working memory/ inhibitory control battery demonstrated sensitivity to the effects of pediatric concussion with reduced response speed and increased response variability. These effects persisted over the 17 day period. Children with mTBI showed normal decrements in accuracy, speed and consistency with increasing working memory load and inhibitory control demand. It remains important to study the full recovery pattern over a longer period of time, as well as more in depth analysis of working memory performance with this measure.

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**M.E. KRAMER, C. CHIU, S.L. WADE & N. CHERTKOFF WALZ. Neural Correlates of Social Information Processing in Pediatric Traumatic Brain Injury.**

**Objective:** Research suggests that pediatric traumatic brain injury (TBI) contributes to poor social outcomes. Social competence impacts psychosocial adjustment, academic performance, and health status, yet the nature and consequences of social outcomes in childhood TBI remain poorly understood. This study examines the neural correlates of social information processing (SIP) in young children with TBI.

**Participants and Methods:** While undergoing functional magnetic resonance imaging (fMRI) scan, 11 children (mean age 8.3 years) who sustained mild to moderate TBI between the ages of 3 and 7, and 11 typ-

ically-developing children (mean age 9.1 years) viewed video vignettes of child actors portraying the experience and resolution of problematic social situations. For each vignette, participants were prompted to indicate whether they would have responded to the situation in the same way as the protagonist (SIP Task), or to monitor the number of children present in the video (Counting Task).

**Results:** Task performance did not differ between the groups. Both groups demonstrated activation in brain regions hypothesized to contribute to SIP when making the SIP decision compared to the Counting decision. However, children with TBI had greater activation within a subset of these regions compared to typically-developing children. Additionally, choosing socially appropriate responses was correlated with distinct activation patterns in each group.

**Conclusions:** Although both groups activated similar neural networks during the SIP task, subtle differences in brain activation patterns were noted. Early childhood brain injuries may alter activation within the networks important for effective SIP, thus perhaps contributing to deficits in social competence.

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**M.E. KRAMER, C. CHIU & S.L. WADE. Verbal Associative Memory Following Childhood Traumatic Brain Injury: an fMRI Study.**

**Objective:** Children with traumatic brain injury (TBI) often experience memory deficits, although the nature of these deficits, their functional outcome, and possible recovery are not well understood.

**Participants and Methods:** The present functional magnetic resonance imagery (fMRI) study examined the neural activation patterns in a group of young children who sustained mild to moderate TBI in early childhood ( $n = 8$ ), and a group of healthy, typically-developing children ( $n = 14$ ) during a verbal paired associate learning task that promoted the use of two mnemonic strategies differing in efficacy: an imagery strategy promoting associative encoding of the pairs (Imagery condition), and a repetition strategy promoting non-associative encoding (Repetition condition).

**Results:** The children with TBI demonstrated intact memory performance and were able to successfully utilize the mnemonic strategies. However, the TBI group demonstrated altered brain activation patterns during the task compared to the control children. The children with TBI demonstrated several areas of increased activation in the contrast between Imagery and Repetition conditions relative to control children, including the anterior cingulate. However, the TBI group also demonstrated decreased activation compared to controls in components of the memory network when the Imagery and Repetition conditions were compared to a resting baseline condition, most notably in the medial temporal lobes.

**Conclusions:** These findings suggest that early childhood TBI may alter activation within the network of brain regions that support associative memory even in children who show good behavioral performance, and these changes likely persist for years after the injury.

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**E.M. MARK, S.L. WADE, N.C. WALZ, H.G. TAYLOR & K.O. YEATES. Home and Parent Predictors of Pragmatic Language Following Early Childhood TBI.**

**Objective:** To investigate home environment factors as predictors of pragmatic language following preschool TBI.

**Participants and Methods:** Children with severe TBI ( $n=23$ ), moderate TBI ( $n=64$ ), and orthopedic injury ( $n=119$ ) were prospectively recruited. Children were 3-6 years old at injury and were assessed at baseline, 6, 12, and 18-months. Pragmatic language at 18-months was assessed with the Pragmatic Judgment (PJ) subtest from the Comprehensive Assessment of Spoken Language. Pragmatic Judgment taps con-

versational and pragmatic language by presenting children with social situations and asking what they would do or say in response. HOME, an observational measure, assessed the quality and quantity of stimulation and support within the child's home environment. The Life Experiences and Social Resource Inventory (LESRI) and Family Assessment Device (FAD) measured family stressors and social resources. A series of hierarchical linear regression models were tested: Block 1 = child's age-at-injury, race, and SES; Block 2 = Injury severity; Block 3 = FAD, LESRI, and HOME.

**Results:** TBI groups differed significantly from the orthopedic group on PJ scores. The severe group performed worse than moderates, although mean scores for both groups were average. After controlling for demographic and injury variables, HOME score significantly predicted 18-month PJ, uniquely contributing 4% of variance. FAD and LESRI scores did not add significantly to the full model.

**Conclusions:** Although more severe TBI is associated with worse pragmatic language, the average TBI child performed in the average range. Quality of the home environment, as measured by HOME, significantly predicted pragmatic language after TBI, over and above child and injury characteristics.

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**S. MCCANN, A. PATENT, J. ALBERTO & S.C. HEATON. Examination of Attention-Deficit/Hyperactivity Disorder (ADHD) Symptom Ratings and Attention Test Performance in Childhood Traumatic Brain Injury (TBI) and ADHD: Evidence for TBI Subgroups.**

**Objective:** Examination of Attention-Deficit/Hyperactivity Disorder (ADHD) Symptom Ratings and Attention Test Performance in Childhood Traumatic Brain Injury (TBI) and ADHD: Evidence for TBI Subgroups

**Participants and Methods:** Children ages 6 to 16 years who sustained moderate or severe TBI ( $n = 37$ ), diagnosed with ADHD (Inattentive,  $n = 45$ , Combined,  $n = 58$ ), and healthy controls ( $n = 29$ ) were compared using sustained attention tasks from the Test of Everyday Attention for Children (TEA-Ch) and report of DSM-IV ADHD symptomatology from the Conners' Parent Rating Scale (CPRS-R:L).

**Results:** Results of a MANCOVA (age as a covariate) demonstrate that the TBI group performed similarly to ADHD subtypes and significantly worse than normal controls ( $p < .05$ ) on performance-based measures of sustained attention. When compared using a clinically meaningful cutoff of one standard deviation below the mean, the TBI group was within normal limits (WNL) whereas both ADHD subgroups performed in the impaired range. Similarly, ADHD subtypes were rated with clinically significant elevations on all three CPRS-R:L scales, and the TBI group was rated WNL. Post-hoc analysis dichotomized the TBI group into those rated within the clinical range and those WNL on the CPRS-R:L scales. Those with clinically elevated scores performed within the impaired range and were statistically similar to the ADHD subtypes on the TEA-Ch. Conversely, those rated WNL on the CPRS-R:L also performed WNL and similar to normal controls on the TEA-Ch.

**Conclusions:** Findings suggest the presence of a TBI subgroup that experience attention problems similar to children with ADHD. The use of parent-reported ADHD symptomatology may be a useful tool for identifying this subgroup.

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**S.R. MCCAULEY, M.A. MCDANIEL, C. PEDROZA & H.S. LEVIN. Incentive Effects on Time-Based Prospective Memory Performance in Children and Adolescents with Traumatic Brain Injury.**

**Objective:** Time-based prospective memory (PM) is the formation of an intention and performing the intended action at a certain time or

following a specific time interval. There is scant data characterizing PM impairments in children with traumatic brain injury (TBI) and less evidence regarding remediation. The present study used two levels of a motivational enhancement (i.e., a monetary incentive) to ascertain if time-based PM can be improved in children with severe TBI.

**Participants and Methods:** In a cross-over design, children and adolescents ages 9-19 years with orthopedic injuries (OI; N=30), and mild (N=15) or severe TBI (N=12) were compared on two levels of incentive (dollars versus pennies) provided for accurate responses. All participants were at least one year postinjury (range 1-15 years).

**Results:** There was not a carry-over effect ( $F < 1$ ). Main effects of Group ( $p < .0001$ ) and Motivation Condition ( $p < .0004$ ) were significant with no interaction. Age-at-test ( $p < .0003$ ) and age-at-injury effects ( $p < .003$ ) were significant, but time-postinjury was not ( $F < 1$ ). Main effects of gender, FSIQ, verbal memory, and SES were not significant (all  $p > .05$ ). The OI and Mild TBI groups performed significantly better under the high-versus low-motivation conditions ( $p < .03$  and  $p < .008$ , respectively), but the Severe TBI group did not ( $p = .22$ ).

**Conclusions:** These results indicate that while monetary incentives improved performance for children with OI and mild TBI, children with severe TBI were not able to marshal effective strategies and/or resources to support successful time-based PM performance.

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**T. MERKLEY, E.A. WILDE, E.D. BIGLER, X. LI, J.V. HUNTER, G. HANTEN & H.S. LEVIN. Cortical Thinning With Age Progression for Traumatically Brain Injured and Typically Developing Children.**

**Objective:** Cortical gray matter is known to undergo characteristic changes during normal development, showing an increase prior to puberty and a decrease during adolescent years. This has been observed in previous studies by tracking MRI-derived gray matter density over time. The current study investigated the relationship of cortical thickness with age for children with traumatic brain injury (TBI) as compared to typically developing children.

**Participants and Methods:** The sample included 16 children (mean=12.9; range 9-16 years) with moderate to severe TBI (mean GCS=5.7) and 16 demographically-matched typically developing children. T1-weighted volumetric MRI scans were used for the automated cortical thickness measurement using FreeSurfer.

**Results:** In accordance with results of previous studies, parietal regions showed the strongest correlations for cortical reduction with increasing age during adolescence for both groups (left superior parietal  $R^2 = 0.665$ ,  $p < 0.0001$ , right  $R^2 = 0.664$ ,  $p < 0.0001$ ). While a negative correlation between cortical thickness and age was observed for the majority of cortical regions in both groups, certain regions showed a much stronger relation in the TBI group as compared to the controls, including frontal, temporal and cingulate regions. Selected examples include left isthmus cingulate ( $R^2 = 0.316$ ,  $p < 0.018$ ), right lateral orbitofrontal ( $R^2 = 0.515$ ,  $p < 0.035$ ), and right superior temporal ( $R^2 = 0.459$ ,  $p < 0.050$ ). This group by age interaction was most prominent in the right hemisphere.

**Conclusions:** These results suggest that while cortical gray matter loss is a normal feature of development, TBI in childhood may be associated with reduced gray matter during adolescence in some cortical regions, though the exact mechanism and impact on behavioral outcome have yet to be investigated.

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**J.L. MICKLEWRIGHT, T.Z. KING, K. O'TOOLE, C. HENRICH, F.J. FLOYD, E. MCCLURE TONE & M.L. SCHMITZ. Authoritarian Parenting Styles Partially Mediate the Relationship Between Parental Stress and Child Adaptive Outcomes Following Pediatric Traumatic Brain Injury.**

**Objective:** Previous research has demonstrated that family environments influence child outcomes following TBI; the current study exam-

ined the mechanisms through which these variables exert their influence on child recovery processes. Specifically, we proposed that high parental stress would be associated with a greater reliance on authoritarian parenting styles which reduce child participation in the activities of daily living. We hypothesized that authoritarian parenting styles partially mediate the relationship between parental stress and child adaptive outcomes 1-3 years following TBI.

**Participants and Methods:** Forty-four adolescents between the ages of 11-17 with moderate/severe traumatic brain or orthopedic injuries were recruited from a children's hospital. Injury groups were stratified on age at injury ( $M = 13.8$ ,  $SD = 2.51$ ), race, sex, and socio-economic strata. Participants' parents completed the Hollingshead, Stress Index for Parents of Adolescents, Parenting Practices Questionnaire, and Vineland-II.

**Results:** Hierarchical multiple regression revealed that after controlling for a distal measure of family SES, higher parental stress was associated with reduced adaptive outcomes in the TBI group ( $\beta = .70$ ,  $p < .001$ ). Bootstrapped estimates of the indirect effect were significant ( $B = .16$ , 95% CI = -.472, -.003). A remaining direct effect ( $\beta = .58$ ,  $p < .01$ ) indicated that authoritarian parenting styles partially mediate the relationship between parental stress and adaptive outcomes following TBI.

**Conclusions:** High levels of parental distress and a greater reliance on authoritarian parenting styles were associated with reduced child adaptive outcomes following TBI. Our findings 1) suggest that increased parental control may influence recovery processes by limiting child involvement in age-appropriate social-communicative and self-care activities, and 2) highlight multiple targets for intervention within family systems.

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**C.T. NGO, E.A. WILDE, X. LI, E.D. BIGLER, S. YEDURURI, G. HANTEN, J.V. HUNTER, Z. CHU, A.C. VASQUEZ & H.S. LEVIN. Amygdala Volumes Facilitate Emotion Identification in Children With TBI During Recovery.**

**Objective:** The amygdala mediates identification of emotions through reciprocal connections with orbitofrontal and ventromedial structures in the brain (Ghashghaei & Barbas, 2002). Impaired affect recognition has been evidenced in children with traumatic brain injury (TBI) (Pettersen, 1991; Turkstra, McDonald, & DePompei, 2001). This is the first study to examine the relationship between amygdala volumes and affect recognition in children with TBI at multiple time points over the course of their recovery. We hypothesized that amygdala volumes would be positively related to performance on an emotional prosody identification task.

**Participants and Methods:** Participants were 46 children with TBI ( $M = 13.5$  years), and 40 children with orthopedic injury (OI) serving as controls ( $M = 12.1$  years). MRI scans and performance data were obtained at 3 months and 18 months post-injury. Amygdala volumes were quantified using Analyze v. 7.0. The Emotional Prosody Task assessed the ability to recognize prosodic contours of different emotions that were conveyed through spoken, semantically neutral sentences.

**Results:** Statistical analyses controlled for age and total intracranial volume. At three months post-injury, controls outperformed children with TBI on the prosody task ( $p = .019$ ). Multiple regression analysis revealed a positive relationship between amygdala volumes and task performance in children with TBI at 3 months ( $\beta = 3.58$ ,  $p = .037$ ), but not at 18 months post-injury. This relationship was not evident in controls at either time point.

**Conclusions:** Results suggest that during an early phase of recovery, the volume and integrity of amygdala may help compensate for neural injury to facilitate affect recognition in children.

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**L. PARKS, R.A. YEO, J.P. PHILLIPS, R.C. CAMPBELL, R.E. JUNG, A.J. BROWN & W.M. BROOKS. Longitudinal Changes in Ventricle Volume Following Pediatric Traumatic Brain Injury: Predictors of Cognitive Function One Year Later.**

**Objective:** Longitudinal volumetric studies of pediatric traumatic brain injury (TBI) are sparse. The purpose of the current study was to examine changes in ventricular volume in children with TBI over time and to determine how ventricular volume is related to cognitive function. It was hypothesized that children with TBI would have enlarged ventricles (as compared to controls) during both the acute and chronic phases of injury and that ventricular enlargement at time one would predict cognitive function at time two.

**Participants and Methods:** In this study, MRIs and neuropsychological testing were performed on children with TBI (n=38) and control children (n=34) between the ages of six and eighteen. Children with TBI (mean GCS=9) were evaluated at two time points (time one: mean=55 days post injury, n=38; time two: mean=324 days post injury, n=21). Manual tracings of the lateral ventricles and third ventricle were performed using ANALYZE trace and editing tools.

**Results:** Results revealed that ventricular enlargement and deficits in cognitive function were present in the TBI group (as compared to controls) and were correlated with initial injury severity. Lateral ventricle volume and third ventricle volume were significantly correlated with the cognitive composite during the acute phase of injury (time one). During the chronic phase of injury, only third ventricle volume was significantly correlated with the cognitive composite. Examination of the longitudinal data revealed that third ventricle volume significantly decreased between times one and two, while cognitive function significantly improved. Finally, results of regression analyses revealed that third ventricle enlargement at time one was the best predictor of cognitive function at time two.

**Conclusions:** In conclusion, our results reiterate the importance of longitudinal designs in pediatric TBI and indicate the utility of third ventricle volume in the acute phase of injury as a predictor of neuropsychological function.

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**S. PAULOS, W. COLE, C. TANKARD, C. SALORIO & B. SLOMINE. Examining a family intervention for adolescent brain injury on parenting stress and family functioning: Two case studies.**

**Objective:** Increased family stress, burden, and overall dysfunction have been reported following pediatric acquired brain injury (ABI). Research on family-based interventions for pediatric ABI improves family stress and functioning. We developed a short-term, module-based family intervention for adolescents with ABI. Data from two family therapy cases are presented.

**Participants and Methods:** Family one included a 16-year old male post traumatic brain injury. Family two included an 18-year old female post brain tumor resection. For both families, parenting stress was measured with the Parenting Stress Index (PSI). Changes in clinical elevations were examined pre- to post-treatment on the thirteen scales, two index scores, and total stress score. For family two, family functioning was also measured using the Structural Family Systems Ratings, which measures family interactions on six dimensions from healthy to maladaptive using three standardized tasks. Changes in pre and post-treatment ratings were examined.

**Results:** Family one: Pre-treatment report on the PSI indicated clinical elevations in eight scales and Total Stress. Post-treatment report PSI scores revealed a reduction to the normal range in three scales and Total Stress. Family two: Pre-treatment report on the PSI indicated clinical elevations in four scales, whereas post-treatment only one scale (stress related to spouse) remained clinically elevated. Family interactions were rated as maladaptive in three dimensions pre-treatment, whereas post-treatment, all family interaction dimensions were rated as average health or above.

**Conclusions:** These results suggest that our short-term, module-based family intervention for children with ABI shows promise in improving parenting stress and adaptive family interactions post-ABI. Implications for future directions are discussed.

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**J.L. POTTER, S.L. WADE, N.C. WALZ, M.H. STEVENS, K.O. YEATES & H.C. TAYLOR. Permissiveness Parenting Style is Related to Executive Dysfunction after Brain Injury in Young Children.**

**Objective:** Research shows that parenting styles differentially influence children's behavior. Yet, little is known about how parenting influences behavioral recovery after traumatic brain injury (TBI). This study examined the relationship between parenting style (authoritarian, authoritative, permissive) and recovery of executive functioning (EF) following early childhood TBI.

**Participants and Methods:** Participants included 71 children with TBI and 92 children with orthopedic injuries (OI), ages 3-7 at time of injury. Assessments were completed at four time points across the initial 18 months post-injury. The Behavioral Rating Inventory of Executive Functions (BRIEF: GEC) measured EF. The Parenting Practices Questionnaire, completed at baseline, assessed parenting style. Mixed model analyses, using pre-injury EF (assessed at baseline) as a covariate, examined the relationship of parenting style to recovery of EF skills over time in children with severe (n = 21) and moderate (n = 50) TBI compared to OI.

**Results:** The severe-TBI group had higher GEC scores (poorer EF) than the OI group at all assessments after controlling for pre-injury scores. Permissiveness moderated the effects of TBI on GEC differently depending on the time since injury. Specifically, greater permissiveness was associated with higher GEC for severe-TBI (6 months) and for moderate-TBI (12 months). By 18 months, all groups showed the same weak positive association between permissiveness and GEC. Authoritarian and authoritative parenting styles were not associated with GEC after controlling for pre-injury GEC.

**Conclusions:** Permissive parenting style may help explain increased executive dysfunction in children, with differing effects over time as a function of injury severity.

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**M. PRASAD & L. EWING-COBBS. Pilot Study of a Home-Based Caregiver Focused Intervention for Very Young Children with Traumatic Brain Injuries.**

**Objective:** Very young children with moderate to severe traumatic brain injury (TBI) have been found to have significant and pervasive impairments in cognitive and motor development. Yet there are no published studies on interventions for infants and preschoolers with TBI. In general, young children with TBI are referred less often to rehabilitation facilities than older children and adults. This study piloted a home-based caregiver focused intervention for families of young children with TBI.

**Participants and Methods:** Eleven young children with TBI under the age of 5 years participated in this pilot study. Children were videotaped playing with their caregivers and also underwent a developmental evaluation before the start of the intervention and at the conclusion of the intervention. Children and their caregivers were visited in their homes every two weeks for an eight week period by a therapist. A new developmental activity was selected every two weeks. The activity was selected based on the child's cognitive or motor weaknesses.

**Results:** Comparing pre-intervention scores to post intervention scores revealed moderate effect sizes on several subscales of the Mullen Scales of Early Learning (expressive language d=.61; receptive language d=.60; early learning composite d=.46). In addition, large effect sizes were found for caregiver stimulation (d=.95) and for the child's interest in playing with the caregiver (d=1.21).

**Conclusions:** These findings indicate that the caregiver-based intervention positively impacted the child's developmental outcome and the caregiver's interaction style with the child. Increased parental teaching at home may significantly enhance recovery from brain injury in early childhood. Supported by HG133G040279

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**D. RACHES, M.R. PRASAD, J.K. WAUGH, P. CIRINO, M. BARNES & L. EWING-COBBS. Word Problem Solving and Attention in Children with Traumatic Brain Injury.**

**Objective:** Children with traumatic brain injury (TBI) often struggle with attention, math computation and/or problem solving. This study explores how word problem solving (WPS) of children with TBI is affected by task demands and by behavioral inattention.

**Participants and Methods:** WPS and attention ratings were examined in 76 children ages 7-16 with TBI and in 64 community comparison children. Math performance was assessed using the Arithmetic and Complex Word Problem Solving Test (ACWPT), which examines components of word problem solving, including performing a calculation, identifying correct problem set-up, and independently solving a word problem. Parent ratings of attention were collected.

**Results:** The comparison group had a higher ACWPT total score than the TBI group ( $p=0.0023$ ). Children with TBI were less accurate in calculation ( $p=0.039$ ), identifying WPS set-up ( $p=0.044$ ), and in independent WPS ( $p=0.041$ ). Groups performed comparably on word problems (WP) with no or verbal distracting information. However, children with TBI were less accurate when WP contained extraneous numeric information ( $p=0.011$ ).

Children with TBI demonstrated greater inattentiveness ( $p<.001$ ) and hyperactivity ( $p=.012$ ) than controls. Interestingly, when inattentiveness and hyperactivity were individually controlled for, group math performance differences were no longer evident. The effect of TBI on WPS was mediated primarily by the effect of behavioral inattention and hyperactivity/impulsivity.

**Conclusions:** Similar to findings in children with math learning disabilities, inattention may contribute to significant math performance weaknesses in children with TBI. The WPS of children with TBI was particularly disrupted by extraneous numeric information. The role of inattention and inhibitory control difficulties in WPS should be further examined. R01 NS 46308, P01 HD 046261.

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**K. SINOPOLI, J. MAX, H. LEVIN, X. LI, R. SCHACHAR & M. DENNIS. Relations Among Mechanism of Injury, Injury Severity, Age at Injury, and Pre-morbid Behaviours in Childhood Traumatic Brain Injury.**

**Objective:** Survivors of childhood traumatic brain injury (TBI) often endure life-long cognitive-behavioural problems. While younger age at injury often predicts more severe injuries and more negative cognitive-behavioral sequelae, there is little research concerning how pre-morbid behaviours contribute to the mechanism of injury, and how each of these variables contributes to the severity of TBI.

**Participants and Methods:** We first classified 120 children with mild to severe TBIs on mechanism of injury and whether or not the child's behaviour contributed to the TBI. We next examined whether pre-morbid behavioural characteristics were related to the severity and the mechanism of injury in 33 children for whom pre-injury data were available.

**Results:** The most common cause of injuries was falls ( $\chi^2=37.6$ ,  $df=2$ ,  $p<0.0001$ ), with the behaviour of the children themselves contributing significantly to the falls ( $\chi^2=38.9$ ,  $df=5$ ,  $p<0.0001$ ). TBI under age 7 was significantly related to falls, whereas TBI over age 7 was significantly related to pedestrian accidents ( $\chi^2=15.5$ ,  $df=2$ ,  $p<0.0001$ ). Chil-

dren whose behaviour contributed to their own injuries were more likely to be over age 7 ( $\chi^2=12.3$ ,  $df=2$ ,  $p=0.002$ ). Falls were responsible for significantly more mild and complicated mild injuries, falls and pedestrian accidents were more common in moderate TBIs, and severe TBIs were caused equally by falls, motor vehicle, and pedestrian accidents ( $\chi^2=16.2$ ,  $df=6$ ,  $p=0.012$ ). Contrary to our hypotheses, pre-morbid attention and/or externalizing behaviour problems was not significantly related to the mechanism of injury or to TBI severity.

**Conclusions:** Mechanism of injury is related to age at injury and injury severity, but not pre-morbid behaviours.

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**C.T. WELLS, L. KRIVITZKY, D.W. BEEBE, S. WADE, N. WALZ, K.O. YEATES, H.G. TAYLOR & T. STANCIN. Sleep Problems Following Traumatic Brain Injury in Preschool Children: A Longitudinal Investigation.**

**Objective:** Traumatic brain injuries (TBI) in adults are known to affect sleep quality and quantity. We recently published evidence that severe TBI in school-aged children is followed by a sharp and persistent increase in sleep problems. Sleep problems can seriously compromise a child's quality of life, potentially impact cognitive functioning and result in considerable parent distress. We know little about the effects of TBI in very young children.

**Participants and Methods:** Subjects for this study were part of a longitudinal study of injured preschool children. There were a total of 210 subjects (122 male, 88 female) divided into three groups: orthopedic injury ( $n=112$ ,  $M\ age=5.1\pm 1.1$ ), mild TBI ( $n=55$ ,  $M\ age=4.9\pm 1.2$ ), and moderate to severe TBI ( $n=43$ ,  $M\ age=5.1\pm 1.1$ ). Caregivers completed a validated sleep questionnaire on four occasions: 1 month post-injury that asked about pre-injury functioning, and again at 3 follow-up points (6 month, 12 month, and 18 months post injury).

**Results:** Significant differences at baseline were noted across groups in level of parent education and age at injury. After covarying for parent education and age at injury, there were no significant differences at baseline for any of the sleep subscales. At 6 months post-injury, there was a significant effect of group on sleep duration, with the mild group reporting the most problems. There were no significant differences at the 12 or 18 month visits for any of the sleep scales.

**Conclusions:** These results suggest some initial impact of TBI on sleep in the acute recovery period, but over time these problems appear to remit.

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**T. WU, E.A. WILDE, R. YALLAMPALLI, E.D. BIGLER, Z. CHU, X. LI, J. HUNTER, A.C. VASQUEZ & H. LEVIN. Longitudinal Changes of the Corpus Callosum Pathways Subsequent to Traumatic Brain Injury.**

**Objective:** Individuals with traumatic brain injury (TBI) exhibit variable functional outcome over time. While some improvement on standardized measures may be due to practice effects, research suggests the possibility of neural plasticity. Diffusion tensor imaging (DTI) enables the identification of microstructural alterations that may be less apparent on conventional imaging. This study examined longitudinal changes in the corpus callosum (CC) in a small subset of adolescents with TBI as compared to orthopedically-injured (OI) controls.

**Participants and Methods:** Three individuals (2 females and 1 male) with moderate-to-severe TBI and demographically-matched OI controls (1 female and 2 males) between the ages of 14-16 underwent 15-direction DTI on Philips 1.5T scanners. Quantitative fiber tractography was performed on the total CC in the sagittal plane using Philips PRIDE v4.1 fiber tracking software. DTI indices included fractional anisotropy (FA) and apparent diffusion coefficient (ADC) for fibers coursing through the CC.

**Results:** While not uniformly evident in a larger cohort of subjects, the increase in FA for patients comprising this TBI subgroup exceeded the expected change that could be attributed to normal development alone. For instance, one patient had an increase of 0.057 for FA compared to 0.010 of her matched control. This observation was further supported by qualitative assessment of tractography, in which changes in the white matter of the CC were evident at 18 versus 3 months post-injury. As expected, FA increases were also accompanied by decreases in ADC.

**Conclusions:** DTI is a promising tool to further investigate longitudinal changes in white matter following TBI.

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## Symposium 9: Adult Outcomes of Childhood Cancer: Emerging Transdisciplinary, Lifespan Research

Chair: M. Douglas Ris

Discussant: Maureen Dennis

1:30–3:00 p.m.

**M. RIS, M. DENNIS, K. KRULL, L. ELLENBERG, M. RIS, K. EDELSTEIN, B. SPIEGLER & C. REY-CASSERLY. Adult Outcomes of Childhood Cancer: Emerging Transdisciplinary, Lifespan Research.**

**Symposium Description:** Children are surviving cancer at increasing rates. Survival rates differ dramatically across the various childhood cancers, and among survivors the quality of survival is also diverse. The true legacy of childhood cancer spans the entire life and a better understanding of these survivors' life trajectories is a significant public health concern. Papers in this Symposium represent a broad range of diagnoses, treatment toxicities, and outcome methodologies. Dr. Kevin Krull will describe an ongoing, landmark epidemiologic study, the Childhood Cancer Survivor Study (CCSS), the development of a novel tool (CCSS Neurocognitive Questionnaire) used in this study, and preliminary data from a St. Jude sample. Dr. Leah Ellenberg will report on adult outcomes on the Neurocognitive Questionnaire of a large, diverse sample drawn from the CCSS. Dr. Ris will then review the literature on adult outcomes of pediatric low grade tumors, including a new study being conducted through the CCSS on such patients and preliminary data from this study. Drs. Edelstein and Spiegler will then present on adult survivors of childhood medulloblastoma who were treated with radiation. This will be followed by Dr. Rey-Casserly's presentation of the relationships between social functioning, adaptive skills, and executive functioning in older adolescent and young adult cancer survivors. Finally, Dr. Maureen Dennis, as discussant, will help to place childhood cancer in a lifespan context with reference to factors of risk and reserve in adults suffering childhood brain insults.

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**K. KRULL. Neurocognitive Functions in Adult Survivors of Childhood Cancer: Assessment issues and practical implications.**

**Objective:** Assessment of neurocognitive functions in adult survivors of childhood cancer presents new opportunities for research, as well as procedural challenges and implications for data application. The goal of this presentation is 1) to discuss an assessment tool developed in the Childhood Cancer Survivor Study (CCSS), 2) to demonstrate the relation between this tool and traditional neuropsychological measures, and 3) to describe the implications such assessment has for functional outcomes in adults.

**Participants and Methods:** A neurocognitive questionnaire (CCSS-NCQ) was standardized in 6,739 adult survivors of childhood cancer and 382 of their siblings. Over 200 adult survivors were also evaluated at St. Jude Children's Research Hospital as part of an ongoing lifetime cohort study. All participants were over 18 years of age and at least 10 years post-diagnosis.

**Results:** The CCSS-NCQ demonstrated four reliable factors that assess attention and processing speed, memory, and executive functions, all with good construct and discriminative validity (all  $p$  values < .0001). The questionnaire corresponds well to direct performance measures with good specificity. Furthermore, performance is related to functional outcomes, health status, and health-related behaviors.

**Conclusions:** Neuropsychological assessment in adult survivors of childhood cancer reveals problems concentrated in specific areas of functioning. These problems can be reliably assessed via questionnaire and/or direct performance measures. However, precautions are suggested in determining implications of outcome data.

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**L. ELLENBERG. Neuropsychological Status in Long-Term Survivors of Childhood Brain Tumors: A Report from the Childhood Cancer Survivor Study.**

**Objective:** Among survivors of childhood cancer, those with CNS tumors have been found to be at greatest risk for neuropsychological dysfunction in the first few years following diagnosis and treatment. This study follows survivors to adulthood to assess the long term impact of childhood CNS tumors on neurocognitive functioning.

**Participants and Methods:** As part of the Childhood Cancer Survivor Study (CCSS), 802 survivors of childhood CNS cancers, 5937 survivors of other childhood cancers and 382 siblings completed a 25 item Neurocognitive Questionnaire (CCSS-NCQ) at least 16.1 years post cancer diagnosis which yielded 4 reliable factors assessing task efficiency, emotional regulation, organizational skills and memory.

**Results:** Survivors of CNS tumors reported substantially greater neurocognitive impairment on the CCSS-NCQ than other cancer survivors or siblings ( $p < .001$ ). Within the CNS tumor group, medical complications, including hearing deficits, paralysis and cerebrovascular incidents, as well as completion of the form by proxy predicted more reported deficits on all CCSS-NCQ factors. Total or partial brain cranial radiation and VP shunt placement predicted higher Task Efficiency and Memory scores. Female gender predicted higher scores on Task Efficiency, Emotional Regulation and Memory while diagnosis before age 2 predicted less impairment on the Memory factor.

**Conclusions:** Survivors of childhood CNS tumors are at significant risk for impairment in neurocognitive functioning in adulthood, particularly if they have received cranial radiation, had a VP shunt placed, suffered a cerebrovascular incident or have hearing or motor impairments. It is important to continue to follow and treat high risk groups of CNS tumor survivors.

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**M. RIS. Adult Outcomes of Pediatric Low Grade Brain Tumors.**

**Objective:** Over the last 30 years, a substantial scientific literature has developed attesting to the increased risk for neurocognitive sequelae faced by survivors of pediatric brain tumors. This literature addresses the most aggressive/malignant tumors receiving multimodal, neurotoxic therapies, with relatively little attention paid to low grade tumors receiving less toxic treatments. While late effects in children with low grade brain tumors may not be as severe as in higher grade tumors, they comprise the highest incidence pediatric brain tumors and so the net social burden represented by life-long accrued disability and under-employment may be substantial.

**Participants and Methods:** In this presentation, the existing literature on pediatric low grade brain tumors is reviewed, survey data on low grade survivors is gleaned from the Childhood Cancer Survivor Study (CCSS), and a new study of adult outcome of survivors of low grade brain tumor is described. This study uses a national sample drawn from the CCSS to examine in detail the neuropsychological functioning and socioeconomic status of 260 adult survivors ranging in age from the mid 20s to late 50s compared to 156 matched healthy controls.

**Results:** Survey data from the CCSS indicate that adult survivors of pediatric low grade brain tumors report more symptoms of depression, anxiety, and somatization than healthy controls, and that their level of employment and educational attainment are lower. Key items drawn from the Adult version of the BRIEF further indicate more self-reported dysexecutive symptoms than controls.

**Conclusions:** Preliminary survey data from the CCSS suggest remote sequelae in survivors of low grade brain tumors, with a new study promising to greatly increase our understanding of adult outcome. Developmental factors at both ends of the age continuum that potentially moderate neurobehavioral outcome will be discussed.

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#### K. EDELSTEIN & B. SPIEGLER. Adult Survivors of Childhood Medulloblastoma.

**Objective:** Medulloblastomas are malignant tumors of the posterior fossa that most often occur in childhood. With advances in treatment, including craniospinal radiation, survival rates improved and currently approach 70%. However, cranial radiation is associated with progressive decline in cognitive function, and younger children are particularly vulnerable to its deleterious effects. Increased risks for accelerated aging due to treatment late effects have been suggested, but very little is known about the first generation of survivors as they approach middle age

**Participants and Methods:** We will present a series of 16 adults who received radiation for medulloblastoma between 1 and 13 years of age (median 5.9 years) and were seen for neuropsychological assessments 8 to 42 years (median 20 years) after diagnosis. Data from prior neuropsychological assessments conducted 1 to 31 years (median 6.6 years) after diagnosis were available for 13.

**Results:** Consistent with previous reports, WASI FSIQ scores were correlated with age at diagnosis (Pearson  $r = .53$ ,  $p = .04$ ; mean  $\pm$  SD,  $87.1 \pm 15$ ). However, scores ranged from 58 to 113, and 3 people diagnosed before age 6 had scores at or above the average range. Moreover, individual changes in IQ from first to last assessments ranged from -21 to +11 points, and were not correlated with age at or time since diagnosis. Similarly, variability in academic achievement, processing speed, attention, memory, and executive function were evident in this cohort, with one of the longest and oldest survivors showing strong performance on most tests, in contrast with the profound impairment typically reported in this population.

**Conclusions:** We will examine demographic variables and family history in relation to neurocognitive outcomes in each of these cases so that we can begin to ask questions about potential factors that contribute to cognitive risk and resilience in this population.

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#### C. REY-CASSERLY. Social, Adaptive, Intellectual, And Executive Functioning Skills In Older Adolescent and Young Adult Survivors Of Childhood Brain Tumors.

**Objective:** To examine relationships among intellectual, adaptive, social, and executive function skills in adolescent and young adult survivors of pediatric brain tumors.

**Participants and Methods:** Neuropsychological and psychosocial outcome data were collected for 81 (34 female, 47 male) patients over age 16 years diagnosed with a brain tumor before age 22. Median age at diagnosis was 12.4 years; median age at evaluation was 18 years. Common tumor types were astrocytoma (32%), medulloblastoma (18.5%), and craniopharyngioma (12.3%); 38.2% were infratentorial.

Executive functions, IQ, and adaptive skills were assessed with standardized instruments; social functioning was rated by psychosocial diagnostic interview. Stepwise forced entry regression was used to analyze relationships among adaptive, executive function, intellectual, and social skills.

**Results:** Overall levels of IQ and adaptive skills were within the average range (mean IQ = 94, mean adaptive skills = 87); the proportion of individuals with scores at or below 85 for IQ (25%) and adaptive functioning (35%) was higher than expected. Social difficulties, particularly social isolation, were common; 40% had a history of and 34% were currently experiencing social difficulties. History of social difficulties was a significant predictor of deficits in metacognitive skills.

**Conclusions:** A substantial proportion of adolescent and young adult survivors of brain tumors experience late effects affecting intellectual, adaptive, executive function and social skills. History of social difficulties was a significant predictor of executive function deficits in metacognitive skills. Findings suggest that executive functioning and social skills need to be addressed in interventions for long-term survivors of childhood brain tumors.

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### Paper Session 9: Attention Deficit Hyperactivity Disorder

1:30–3:00 p.m.

#### K.G. KELLY, M.J. LARSON, G. LOGAN, A.P. KEY, W. PERLSTEIN & E. FENNEL. Electrophysiological Analysis of Performance Monitoring in Preadolescents with Attention-Deficit/Hyperactivity Disorder.

**Objective:** The goal of this study was to use event-related potentials (ERPs) and behavioral correlates to examine performance monitoring in preadolescents with Attention-Deficit/Hyperactivity Disorder (ADHD).

**Participants and Methods:** Electrophysiological responses to action errors (“error-related negativity”; ERN), feedback stimuli (“feedback-related negativity”; FRN), and inhibition cues (e.g., “inhibition-related positivity”; IRP) were examined in ten, ADHD preadolescents and ten, well-matched controls during performance of a Stop Signal Task. Behavioral and ERP data were examined under different performance-related contingencies, including reward/reward loss, punishment/punishment avoidance, and neutral, accuracy feedback.

**Results:** The ADHD group evidenced: 1) higher error rates and a reduced ERN-like component in the context of preserved post-error slowing, and 2) isolated preservation of the FRN following rewards in the context of reduced activity in response to other feedback. Results also replicated ADHD-related elevations in inhibition errors and amplitude reductions in an IRP. Inhibitory processes did not improve in response to contingencies, yet data support possible motivation effects on the IRP amplitude.

**Conclusions:** Data suggest reduced error sensitivity and processing of punishment and neutral, accuracy related feedback, with evidence of preserved attempts at corrective actions and processing of reward feedback. Findings support the presence of hypoactive performance monitoring processes in preadolescents with ADHD.

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**K. KELSEY, K.A. ESPY, L. WAKSCHLAG, S. WIEBE & T. SHEFFIELD. Impact of prenatal tobacco exposure on neuropsychological substrates of dimensions of ADHD.**

**Objective:** Prenatal tobacco exposure is linked to school age ADHD diagnosis. Although well replicated, the neuropsychological substrates that mediate this relation are not well defined, particularly in very young children where systematic measurement is difficult. The goal was to determine whether PTE affects two dimensions of ADHD diagnosis, impulsivity and hyperactivity, defined by careful analysis of neuropsychological task performance.

**Participants and Methods:** Participants were 237 typically-developing 3-year-olds (49% girls), 22% exposed prenatally to tobacco (PTE). 3-year-olds were administered a revised Snack Delay task, where the child was instructed to maintain a fixed posture (not to move or talk) in the presence of an enticing reward, and while systematically and progressively "induced" to break posture and consume the reward. Impulsivity was measured by the latency to consume the reward and hyperactivity by the number of epochs that contained prohibited movements.

**Results:** As expected, PTE and non-exposed groups differed in the CBCL hyperactive-impulsive symptom scale ( $t=2.07, p<.04$ ). Importantly, the PTE group consumed the reward 33 seconds earlier than their non-exposed peers ( $F=5.78, p<.02$ ). Furthermore, there was a dose-response relation, where those who were exposed through pregnancy took the least time to eat the snack, and those whose mother's quit smoking during pregnancy intermediate between those who were not exposed. In contrast, there were no exposure group differences in the amount of prohibited movement averaged across epochs ( $F=0.13, p>.72$ ).

**Conclusions:** Through systematic manipulation of neuropsychological demands, prenatal tobacco exposure appears to contribute specifically to impulsivity and not to hyperactivity, consistent emerging results in pre-clinical animal models.

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**E. FURUKAWA, T. ROBINSON & G. TRIPP. A Longitudinal Analysis of Cognitive Performance in ADHD: Group versus Individual Effects.**

**Objective:** Attention Deficit and Hyperactivity Disorder (ADHD) is a chronic condition that has debilitating affects over the lifespan. Cross-sectional studies suggest continuity of impairments in intellectual, academic and neuropsychological functioning. However, to date, few studies have examined the developmental trajectory of the cognitive functioning of affected children.

**Participants and Methods:** In the current study, 109 children meeting the diagnostic criteria of DSM-IV ADHD were assessed when they were aged between five and eleven years. Fifty five of these children participated in follow-up assessments four years (+/- four months) after the initial assessment together with an age and gender matched control group.

**Results:** Consistent with cross-sectional findings, children with ADHD obtained significantly lower scores on the measures of IQ, achievement and neuropsychological functioning compared to the normal control. Group level analyses demonstrated stability of intellectual and academic functioning over time. Reliable change analyses confirmed stability of IQ test performance, but indicated one third of children evidenced a decline in academic achievement. A greater percentage of the reliable change in academic achievement was observed among children who were initially diagnosed with Combined Type ADHD.

**Conclusions:** These findings show that group and individual level analyses can paint different pictures of the stability of impairments among children with ADHD. The continued decline of academic functioning independent of behavioral symptoms suggests that the neurodevelopmental trajectory of children of ADHD may be different from that of normal children.

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**J.W. O'BRIEN, L.R. DOWELL, S.H. MOSTOFSKY, M.B. DENCKLA & E.M. MAHONE. Neuropsychological Profile of Executive Function in Girls with ADHD.**

**Objective:** Most research on children with ADHD is based on samples comprised primarily of boys. Although functional impairment is well-established, available research has yet to specify a neuropsychological profile distinct to girls with ADHD. This study examined performance within four components of executive function (EF) in a contemporaneously recruited sample of girls and boys with ADHD, each compared to age- and sex-matched controls.

**Participants and Methods:** 85 girls (33 ADHD, 52 controls) and 108 boys (47 ADHD, 61 controls), ages 8-13, were administered neuropsychological tests emphasizing response inhibition, working memory, planning/organization, and response preparation. Children with ADHD were screened for comorbidities, and were off stimulant medication for testing. Four MANOVAs (ADHD vs. control) examining the EF components were completed separately by sex.

**Results:** There were no significant differences in age between boys or girls with ADHD and sex-matched controls. ADHD subtype distribution did not differ by sex. Among girls, MANOVAs for all four EF components were significant, with large effect sizes (response inhibition  $\eta^2p=.24$ , working memory  $\eta^2p=.18$ , response preparation  $\eta^2p=.21$ , planning/organization  $\eta^2p=.21$ ). Among boys, MANOVAs for inhibition ( $\eta^2p=.24$ ), working memory ( $\eta^2p=.18$ ), and response preparation ( $\eta^2p=.19$ ) were significant; however, no group differences were observed for planning/organization ( $\eta^2p=.05$ ). Girls with ADHD showed deficits in verbal and spatial working memory; boys with ADHD had deficits only in verbal working memory.

**Conclusions:** Compared to age- and sex-matched controls, boys and girls with ADHD show robust deficits (of equal magnitude) in three major EF domains. Girls, but not boys with ADHD, manifest deficits in planning/organization and spatial working memory.

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**M. MAHONE, M.E. RICHARDSON, D. CROCETTI, J.A. CLAUSS, M.B. DENCKLA & S.H. MOSTOFSKY. Regional Frontal Lobe Anomalies in Girls with ADHD.**

**Objective:** Anatomic MRI studies of ADHD have revealed abnormalities in the frontal cortex; however, most of these studies comprised predominantly male samples, for which conclusions about female-specific anomalies cannot be drawn. Examination of total frontal volumes in girls with ADHD (Castellanos et al., 2001) revealed equivocal findings. The current study examined volumes of functionally relevant frontal lobe regions in girls with ADHD.

**Participants and Methods:** 32 girls (15 ADHD, 17 controls), ages 8-13 years participated. The ADHD sample was screened for learning disabilities and psychiatric comorbidities. MPRAGE images were acquired using a 1.5T scanner. Sulcal-gyral landmarks were used to manually delimit functionally relevant regions within the frontal lobe: primary motor cortex, anterior cingulate, deep white matter, premotor cortex regions [supplementary motor area (SMA), frontal eye field and lateral premotor cortex] and prefrontal cortex (PFC) regions [medial PFC, dorsolateral PFC (DLPFC), inferior PFC, lateral orbitofrontal cortex (OFC) and medial OFC]. Regional volumes were normalized to account for individual differences in total intracerebral volume.

**Results:** There were no significant group differences in age, FSIQ, or total left or right frontal lobe volumes. However, girls with ADHD showed significant reduction in left SMA ( $p<.05, \eta^2=0.13$ ), and significant increase in primary motor cortex bilaterally (both  $p<.05, \eta^2>0.13$ ).

**Conclusions:** Functional subparcellation highlights anomalous frontal lobe development among girls with ADHD beyond that detected by measuring whole lobar volumes. Decreased SMA volume suggests dysfunction in circuits important for motor response selection and inhibition; the resulting increase in motor activity may contribute to findings of increased primary motor volume.



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**Invited Debate:**  
**Cognitive/Neuropsychological Assessment is  
 Critical for Learning Disabilities - or is it?**  
**Panelists: Alan S. Kaufman, G. Reid Lyon, Robert  
 L. Mapou, H. Gerry Taylor**

**Chair: Paul Cirino**

**3:00–5:00 p.m.**

**P.T. CIRINO, R.D. MORRIS, A.S. KAUFMAN, G. LYON, R.L. MAPOU & H. TAYLOR. Cognitive/Neuropsychological Assessment is Critical for Learning Disabilities – or is it?**

**Symposium Description:** The purpose of this symposium is to critically evaluate the role of cognitive and neuropsychological assessment for the identification and treatment of learning disabilities in children and adults. Views on the topic can range from the perspective that learning disabilities cannot be identified without a comprehensive neuropsychological assessment, to the perspective that specific cognitive assessment is irrelevant for learning disabilities. The speakers here will examine a range of these positions, and highlight the key issues on both sides of this debate

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**A.S. KAUFMAN. Cognitive/Neuropsychological Assessment is Essential for Identifying and Treating Learning Disabilities.**

**Objective:** Although underachievement is an important consideration for learning disabilities, the reasons for underachievement are so myriad that differentiating among them is virtually impossible without reference to a pattern of cognitive function. The Federal definition of a specific learning disability (SLD) has not changed since 1969. It still stipulates that SLD means a disorder in one or more of the basic psychological processes. Although the IDEA 2004 methodology for identifying SLD ignores the definition, that does not free examiners to do likewise. Cognitive and neuropsychological tools are needed to identify the disorder, especially now that the contemporary assessment scene includes an array of excellent theory-based tests alongside thoroughly updated and improved Wechsler scales. Instead of only providing global IQs, the major cognitive and neuropsychological tests yield profiles of four to seven abilities that greatly facilitate the identification of processing disorders. Additionally, ignoring cognitive assessment makes it impossible to identify bright and gifted children with SLD, as their achievement may be above minimal standards but still represent an ipsative weakness. Finally, cognitive assessment is typically employed after obvious causes such as poor instruction have already been ruled out, and the student has already been shown to be resistant to “easy fixes.” There is a growing body of literature that delineates the cognitive and processing correlates of specific areas of academic deficit, providing empirical support for the use of cognitive tests for differentiating instruction and guiding intervention practices based on each student’s individuality.

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**R.L. MAPOU. Cognitive/Neuropsychological Assessment Makes Key Contributions to the Identification and Treatment of Learning Disabilities in Adults.**

**Objective:** While the general issues raised by other speakers are relevant, the discussion typically focuses on children and cognitive ability

while they are in school. A common reason for referral to a neuropsychologist, who is often in a tertiary setting, is precisely because the situation of the student is not “routine”, thereby diminishing the utility of some standard practice that address only specific academic skills. This is especially true for adults, who are often referred for assessment to determine eligibility for benefits related to a disability or accommodations for instruction or testing in higher education settings. Many of these individuals have not been previously identified. Simply identifying them based on IQ and achievement skills does not provide enough information on the nature of the academic disability, particularly when emotional/behavioral issues are present. There is also no opportunity to run them through a RTI process. Further, much of what we know about the role of interventions for academic skills is focused at the level of the single word (e.g., decoding). We know less about other reading domains (e.g., comprehension) that develop at later ages, and less about other domains (e.g., math) throughout development. Finally, beyond elementary school, much of what is “known” about learning disabilities breaks down, given the relatively sparse literature in this area, particularly relative to what is known about early reading. Whatever advantages of RTI are apparent in this area, they are less clear, particularly at later ages. Issues about learning disabilities are extremely relevant at the college level as well, where there are a host of selection issues at play that make distinctions among academic skills more difficult.

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**H. TAYLOR. Cognitive/Neuropsychological Assessment has a Specific, though Limited Role in the Identification and Treatment of Learning Disabilities.**

**Objective:** Academic skill deficits are the core defining feature of LD. Processing deficits are only probabilistically related to LD and the origins of LD are multifactorial. Neuropsychological assessment thus has limited utility in defining LD or in establishing causation. The more critical role of neuropsychological assessment is in telling us something about LD—through efforts to specify cognitive endophenotypes that help link academic deficits to their biogenetic underpinnings, explore and validate distinct types of academic problems, and predict response to interventions and future academic outcomes. Current research suggests that these skills may be useful in distinguishing different types of academic problems. Clinical assessments can also help to insure comprehensive academic evaluations and support the need to intensify instruction. However, neuropsychological assessment of this population is a work in progress. Progress has been hampered by methodological challenges, including identification of useful measurement constructs and discovery of associations of these constructs with distinct academic abilities. Further progress will require study of specific processing deficit-learning problem associations, examination of the joint effects of biological and environmental factors, and evidence-based approaches to individual identification and management.

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**G. LYON. Cognitive/Neuropsychological Assessment is not Important for Identifying and Treating Learning Disabilities.**

**Objective:** Epitomized by the 2004 reauthorization of IDEA, new models for identification and treatment have emerged based on the child’s response to intervention (RTI). In a RTI model, children are identified in part based on their response to scientifically-based instruction that increases in intensity. A child who shows inadequate instructional response should receive a comprehensive evaluation based on data from attempts to teach the child, norm referenced achievement tests, and contextual factors/other disorders. However, there is little evidence that cognitive assessments contribute information beyond that found in the assessment of academic achievement and contextual factors. When a

student is not achieving at a level consistent with expectations (e.g., some benchmark/criterion), the central issue is how to improve their performance, not whether they are “learning disabled” or not. In other words, cause is less important than effect. Much identification of learning disabilities occurs early in elementary school, yet only after skills are quite far behind, and discrepant from other abilities. There is little evidence for differential effectiveness of treatments in individuals of high or low cognitive ability, and much evidence has accumulated that questions the utility of the discrepancy criterion, at both psychometric and conceptual levels. RTI is highlighted as an alternative to identification in the most recent iteration of IDEA precisely for these reasons.

Moreover, intervention occurs with the skill deficit, not with some underlying cognitive correlate. To use the example of reading, poor performance is frequently related to either poor instruction, or good general instruction that is nonetheless not explicit enough for struggling students; RTI is focused squarely on these issues. Further, we also know so much about decoding skills that understanding its primary cognitive correlates of such a skill is nearly transparent. In other words, the cognitive skills most relevant to decoding are readily inferred from the academic skill itself. In sum, comprehensive evaluations of inadequate responders are necessary and required for identification, but evidence for the added value of a comprehensive cognitive assessment is lacking. Correspondence: *Paul T. Cirino, University of Houston, UH-Texas Medical Center Annex, 2151 W. Holcombe Blvd, Houston, TX 77024-5053. E-mail: pcirino@uh.edu*

### Poster Session 9: Dementia

3:00–4:30 p.m.

#### Dementia (Alzheimers)

**F.S. AHMED, L. CHANDLER, A. INSCORE, A. PROVAN, A. CERNICH, R. KANE & D. LORECK. Prediction of Functional Independence in a Geriatric Veteran Population.**

**Objective:** As the population ages, it is becoming increasingly important to screen for dementia in primary care settings. Several easily administered and brief cognitive screening measures are available. The aim of this study was to determine which of two commonly utilized cognitive screening measures (MMSE, BOMC) best predicted functional independence.

**Participants and Methods:** 495 veterans ranging in age from 66 to 89 years underwent dementia screening in a primary care clinic at the Baltimore VAMC. The Mini-Mental Status Examination (MMSE) and the Blessed Orientation-Memory-Concentration test (BOMC) were administered. Informant ratings of functional independence were obtained via the Functional Activities Questionnaire (FAQ). Multiple regression analyses were used to determine whether the MMSE and the BOMC were useful in predicting functional independence after covarying for several demographic variables (e.g., age, race, marital status, living arrangements, educational level, and income). The MMSE and BOMC were compared with regard to variance accounted for.

**Results:** Both the MMSE and BOMC accounted for significant and unique variance in functional independence beyond that accounted for by demographic variables. Interestingly, both the MMSE and BOMC accounted for a similar amount of variance (MMSE: Adj. R square = 0.265,  $p < .01$ ; BOMC: Adj. R square = 0.276,  $p < .01$ ).

**Conclusions:** The MMSE and the BOMC were equal in their prediction of functional status in an elderly veteran population. Our findings help validate the use of either of these instruments for dementia screening in a primary care setting.

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**E. BALDWIN & S. GALE. The Parietal Variant of Alzheimer's Disease: A Case Report.**

**Objective:** Alzheimer's disease may be a more heterogeneous disorder than previously thought. Parietal atrophy is an atypical presenting feature of Alzheimer's disease. A woman with progressive visuospatial disturbance was seen for neuropsychological evaluation. MRI reportedly demonstrated mild posterior parietal cortical atrophy greater than expected for age. This study presents findings from neuropsychological evaluation consistent with an AD (parietal) variant.

**Participants and Methods:** A 58-year-old, right-handed woman with progressive visuospatial disturbance. The patient received a comprehensive neuropsychological evaluation.

**Results:** Neuropsychological examination was consistent with primary dementing illness with the most pronounced deficits in visuospatial function though memory and executive function were also notably compromised.

**Conclusions:** People with Alzheimer's disease can have atypical presentations with prominent early deficits other than episodic memory. The recognition of atypical presentations of Alzheimer's disease is important for detecting possible clinical variants of this dementing condition.

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**A.C. CHANG, N.C. MCLAUGHLIN, P. MALLOY & V. WILLIAMS. Measures of Frontal Lobe Function Predict Activities of Daily Living in Patients with Alzheimer's and Lewy Bodies Dementia.**

**Objective:** Dementia with Lewy Bodies (DLB) is thought to be the second most common neurodegenerative disorder after Alzheimer's dementia (AD), but there is little research on cognitive and behavioral aspects of DLB. Functional impairment, a prominent feature of dementia, is often the first indication of the neurodegenerative process and one of the most frustrating for patients and their caregivers. In the present study, the contribution of frontal lobe pathology to the functional impairments in DLB and AD patients was assessed.

**Participants and Methods:** Using retrospective data collected from an outpatient memory clinic, 32 patients with AD and 23 patients with DLB were matched by age, education, and MMSE scores. The Frontal Systems Behavior Scale (FrSBe) was utilized to predict functional outcome as measured by the Lawton-Brody Activities of Daily Living Questionnaire (LB-ADL) completed by the patients' caregiver.

**Results:** The results support previous findings that frontal behavioral syndromes contribute to functional impairments. Particularly, regression analyses showed that apathy is a significant predictor of basic ADL functions in AD patients while executive dysfunction has a significant association with instrumental, basic, and total ADLs in DLB patients.

**Conclusions:** Different components of frontal lobe function predict the daily functioning of AD and DLB patients. This differentiation between DLB and AD patients can be useful in diagnosis, intervention, and treatment planning. Frontal-subcortical pathology in DLB patients is hypothesized to underlie these findings, which provide a basis for further investigation.

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**J.B. DAVE, C.A. MCCLEARY & B.G. KNIGHT. The Longitudinal Association Between Domain-Specific Cognitive Complaints and Performance in Older Adults with Normal Cognition and with Alzheimer's Disease.**

**Objective:** Cross-sectionally, memory complaints often are not closely associated with memory performance but are thought to be predictive of future memory decline. We aimed to determine whether individuals' complaints about change in memory accurately reflect recent decline on memory tests from a previous time point in both Alzheimer's disease and normal aging. In addition to memory complaints, we also examined the association between complaints and performance for both attention and language.

**Participants and Methods:** One-hundred-thirty-four older adults (72 with Alzheimer's disease, 62 with normal cognition) completed neuropsychological tests (e.g., CERAD word list task, Trailmaking Test A, and Boston Naming Test) and a measure of subjective complaints over multiple time points. Levels of depressive symptoms were also measured.

**Results:** Latent difference models revealed that dementia group status moderated the relationship between complaints and performance for attention only. Specifically, in the AD group, complaints about attention were significantly associated with concurrent attention performance and with decline in attention from a prior time point. Those with normal cognition did not have accurate complaints either cross-sectionally or longitudinally. Consistent with prior research, complaints were highly associated with depressive symptoms.

**Conclusions:** Individuals with AD are poor estimators of change in their own memory and language abilities but may more readily notice decline in attention. The role of depression and other possible factors influencing estimation of cognitive changes will be discussed.

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**L.M. ERCOLI, P. SIDDARTH, V. KEPE, K.J. MILLER, P. CERNIN, H. HUANG, H. LAVRETSKY, J.R. BARRIO & G.W. SMALL. Plaque and Tangle Imaging Predicts Cognitive Decline in Nondemented Older Adults.**

**Objective:** We explored whether positron emission tomography (PET) with 2-(1-[6-[(2-[F-18]fluoroethyl)(methyl)amino]-2-naphthyl]ethylidene)malononitrile (FDDNP), a molecule that binds to plaques and tangles in vitro, can predict cognitive decline in older adults.

**Participants and Methods:** Thirty four nondemented subjects (N = 18 with normal cognition, NC; Mean age = 70.41 sd = 10.57 and N = 16 with Mild Cognitive Impairment, MCI; mean age = 68.14, sd = 10.82) underwent FDDNP-PET scanning and neuropsychological testing at baseline and 2.3 years later. Logan parametric FDDNP-PET images were produced using cerebellum as a reference region. Relative distribution volumes were obtained for regions of interest (ROIs) known to accumulate plaques and tangles in Alzheimer's disease. Neuropsychological data were reduced to 5 composite domain variables: Memory, Attention/Information processing speed, Language, Visuospatial; Executive. ANCOVAs were conducted to determine whether baseline FDDNP-PET signal predicted cognitive decline, controlling for baseline neuropsychological performance.

**Results:** For all subjects, higher baseline FDDNP-PET signal in global, parietal and lateral temporal ROI predicted Language domain decline. Higher baseline FDDNP-PET signal in global, parietal and frontal ROI predicted Visuospatial domain decline (p value range = .004 - .05).

**Conclusions:** In nondemented persons, higher FDDNP-PET signals globally and in select ROI at baseline were predictive of cognitive decline 2 years later. These results have implications for the use of FDDNP-PET as a tool for assessing dementia risk in middle aged and older adults. Continued follow-up is underway in order to examine, in a larger sample, the ability of FDDNP-PET to predict cognitive outcomes for CN and MCI groups separately.

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**P.S. FOSTER, V. DRAGO, J. PEARSON, M. MEISNER, T. GIOVANNETTI, D. LIBON & K.M. HEILMAN. Reduced Spreading Activation of Lexical Networks in Alzheimer's Disease.**

**Objective:** Alzheimer's disease (AD) is known to affect semantic memory networks. Some have postulated that the semantic memory impairment in AD may be related to a reduction in spreading activation. We have previously used the average word frequency from the Controlled Oral Word Association Test (COWAT) and the Animal Naming (AN) test as indices of the extent of spreading activation in lexical net-

works. Words with higher frequencies should have stronger and more frequent connections than words with lower frequencies, which have fewer connections and lie more in the periphery of lexical networks. Thus, increased spreading activation should be associated with lower average word frequencies and reduced spreading activation with higher average word frequencies. In this investigation we sought to use this same paradigm to investigate whether AD is associated with reduced spreading activation.

**Participants and Methods:** A total of 25 patients diagnosed with probable AD and 20 healthy controls completed the COWAT and the AN tests. Average word frequencies for each test were then calculated for all participants.

**Results:** Separate between groups ANOVAs, using the average COWAT and AN word frequencies as the dependent variable, indicated that the average AN word frequency for the AD patients (M = 41.42, SD = 17.24) was significantly higher than that of the normal controls (M = 23.95, SD = 8.68). No difference was found for the average COWAT word frequency.

**Conclusions:** Hence, these results suggest that AD is associated with reduced spreading activation in lexical networks.

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**A. INSCORE, A. PROVAN, R. KANE & D. LORECK. Utility of the CERAD Boston Naming Test in Predicting Dementia Status in a VAMC Primary Care Sample.**

**Objective:** Dysnomia is one of the hallmark symptoms of early Alzheimer's disease (AD), yet factors other than neuropathology can account for word-finding difficulties (e.g., education, social or cultural factors). We sought to establish the value of the CERAD 15-item Boston Naming Test (BNT) in predicting dementia status in a sample of elderly veterans.

**Participants and Methods:** Participants were 106 veterans ranging in age from 66 to 89 years who underwent dementia screening in a primary care setting. The majority were married Caucasian men. Educational level ranged from no formal education to having completed graduate school. Subjects were classified as having probable, possible, or no dementia based on MMSE score and collateral report of functional status. Multiple regression and discriminant function analyses were used to determine whether the CERAD BNT was useful in predicting group membership while also taking age, education, and ethnicity into consideration.

**Results:** Multiple regression analyses revealed that age, ethnicity, and education combined were significant predictors of dementia status (R square = 0.147, p < 0.01). Entering CERAD BNT in a second block improved the predictive validity of the equation (R square = 0.293, Bstand = -0.429, p < 0.001). Discriminant function analysis, however, revealed that only 60% of cases were correctly classified with the latter model (sensitivity = 42%, specificity = 73%).

**Conclusions:** While it did add value in predicting dementia status, in our sample, the CERAD BNT appeared to be more useful in ruling out dementia than in ruling it in. Lower scores on the CERAD BNT should be interpreted with caution.

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**D.A. KAUFMAN, S.M. MITCHELL, B.C. SACHS, J.J. TANNER, L.L. HOWE & D.W. LORING. Differentiating Semantic and Motor Perseverations in Memory Disorder Patients.**

**Objective:** Perseverative behavior in dementia appears to be hierarchically organized based on the degree of semantic and motoric processing that is required for a given task. The current study utilized a dementia version of the Graphical Sequences Test (GST; Lamar et al., 1997) as part of a broader neuropsychological protocol to examine the relationships between semantic and motor perseverations and other cognitive functions.

**Participants and Methods:** Fifty-one patients referred to a memory disorders clinic were given the GST as part of their neuropsychological evaluation. GST perseverative errors were subjected to Pearson correlations with performance on measures of executive functioning, Luria motor tasks, and verbal memory.

**Results:** Perseverations of activity (e.g., writing instead of drawing) and element (e.g., substituting shapes) demonstrated unique relationships with measures of working memory, cognitive flexibility, inhibition, and immediate verbal memory (lists and stories). Perseveration of feature (e.g., spatial characteristics) and captured perseverations (e.g., substituting letters for shapes) were uniquely associated with errors on the Luria contrasting motor programs and the Fist-Edge-Palm test.

**Conclusions:** This study found that perseverative behavior in memory disorder patients was hierarchically organized by the complexity of the cognitive symptoms present. Disruptions in executive function and verbal memory were both associated with semantic perseverations, while motor sequencing problems were associated with the forms of perseverative behavior that are believed to reflect the border between semantic and motor processing. These divergent patterns offer insights that are useful for characterizing frontally-mediated deficits that accompany memory disorders and better understanding their relationships to broader domains of functioning.

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**R.P. KESSELS & L.M. OLDE HENSKEN. Errorless skill learning in people with mild-to-moderate or severe dementia and older adults.**

**Objective:** To determine whether learning without errors is advantageous compared to trial-and-error learning in people with severe, mild-to-moderate or no dementia using a procedural task and a randomized case-control design.

**Participants and Methods:** Participants were recruited from a nursing and care home and included 20 severe Alzheimer patients, 20 patients with mild-to-moderate dementia and 20 controls without dementia. The participants had to acquire a novel procedural problem-solving task (the Action Programme subtest from the BADS) with the help of cues (errorless learning) or with cues only given in case an error was made (trial-and-error learning). The number of steps completed without assistance immediately after errorless or trial-and-error learning and after a delay of 1-3 days.

**Results:** Overall performance was better after errorless learning compared to trial-and-error learning ( $p=0.012$ ), with effect sizes being the largest in the mild-to-moderate dementia group after delayed testing (Cohen's  $d=1.61$ ). The effects of errorless learning were overall larger after delayed testing compared to immediate testing.

**Conclusions:** Errorless learning of a procedural task results in a better performance than learning with errors. This is the first controlled group study to show such a benefit in dementia patients, possibly mediated by spared implicit memory function. Since our findings can be extended to the acquisition of tasks that are relevant for everyday life functioning, the results may have important implications for dementia care. Moreover, the current results will be related to previous findings on errorless learning.

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**N. MAHENDRA & A. CHANDREGOWDA. Text Reading Speed And Reading Comprehension In Healthy Older Adults And Persons With Dementia.**

**Objective:** The purpose of this study was to compare the performance of healthy older adults (HOA) and age- and education-matched persons with dementia (PWD) on measures of reading speed, comprehension, and ability to generate a title for a short story.

**Participants and Methods:** Twenty seven PWD and twenty four HOA from the East Bay region of the San Francisco Bay area participated in

this ongoing study. All were timed as they silently read a short story from the Gray Oral Reading Test (GORT). Following this, each was asked five multiple-choice questions targeting verbatim recall or inferential processing of information in the story. Finally, participants had to generate an appropriate title for the story.

**Results:** Data revealed significant between-group differences in reading speed with PWD taking longer to read a short story than HOA. Next, despite PWD taking longer to read the story, reading comprehension performance of PWD was significantly poorer than HOA. Qualitative analyses will be presented regarding group differences and variability in title generation performance.

**Conclusions:** Whereas much is known about linguistic communication abilities in PWD, comparatively little is known about reading speed and comprehension. Reading is a foundational cognitive-linguistic skill and the need to read and comprehend information is pervasive in our daily lives. Studies on reading in PWD are scarce and restricted to focus on reading accuracy and comprehension of regular and irregular words and sentences. This study adds to the literature on text reading speed and reading comprehension and suggests that text reading ability is impaired even in persons with mild dementia.

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**N. MAHENDRA & K. SCHONEMAN. Hearing Screenings for Older Adults With and Without Dementia: Outcomes and Clinical Implications.**

**Objective:** This study was designed to conduct hearing screenings for long-term care residents, document outcomes, and highlight clinical implications of hearing screenings for older adults with and without dementia. We wanted to determine if: a) hearing status varies between healthy older adults (HOA) and persons with dementia (PWD) who live in the same facility, and b) if there is a relationship between hearing aid use in HOA and PWD and performance on hearing screening tests.

**Participants and Methods:** 24 HOA and 31 PWD ranging in age from 75 to 96 years, with a mean of 13 years of education, participated in a comprehensive hearing screening examination. This screening consisted of otoscopy, pure tone audiometric screening at frequencies from 500 Hz to 6000 Hz, and face-to-face word recognition testing.

**Results:** 84% of HOA and 66% of PWD demonstrated hearing loss in one/both ears. Twice as many PWD passed screening at low frequencies (500 Hz, 1 kHz, 2kHz) bilaterally than HOA. At high frequencies (4000 and 6000 Hz), all HOA and 74% of PWD failed screening in one/both ears. Substantially more PWD passed high frequency screening bilaterally than HOA. Despite PWD having better hearing than HOA, remarkably, more PWD wore hearing aids than HOA. Even with this difference in hearing acuity between groups, the two groups had similar word recognition scores.

**Conclusions:** Given that hearing loss is very common among older adults, is often undetected and untreated, and that poor hearing acuity confounds reliable and valid neuropsychological testing, older adults must have frequent hearing screenings.

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**N. MAHMOUD, N. TORRENCE, G. DANCEL, S. BAYAN & J. RAZANI. Effects of Dementia Patients' Decline in Daily Functioning on Various Aspects of Caregiver Burden Over a One-Year Period.**

**Objective:** The purpose of this study was to examine the effects of dementia patients' deficits in daily functioning on the types of burden caregivers experience over a one-year period. We hypothesize that over a one-year period, dementia patients' decline in daily functioning will have an effect on various aspects of caregiver burden.

**Participants and Methods:** Twenty-nine dementia (Alzheimer's disease and vascular dementia) patient-caregiver dyads participated in this study. A performance-based measure, the Direct Assessment of Functional Status (DAFS) test, was administered to the patients, while next-of-kin caregivers completed the Caregiver Burden Inventory (CBI). For the purpose of this study, the following 5 DAFS subscales were assessed: Time Orientation (orientation to person, place, and time), Communication Skills (e.g., using a telephone), Transportation Skills (e.g., identifying road signs), Financial Skills (e.g., balancing a checkbook), and Shopping Skills (e.g., shopping from a mock grocery store). For the CBI, a total score and the following 5 subscales were obtained: Time Dependence, Developmental Burden, Emotional Burden, Social Burden, and Physical Burden.

**Results:** Bivariate correlations between patients' DAFS scores and their caregivers' burden measures revealed a significant relationship between 3 CBI outcome measures (CBI Total, CBI Time Dependence and CBI Physical Burden) and the DAFS Shopping subscale. That is, as the patients' ability on the DAFS Shopping subscale declined over a one-year period, caregivers' time constraints and physical burden increased. No other relationships were found.

**Conclusions:** Examining the relationship between functional decline in dementia patients and increased burden in circumscribed areas of caregiving is important for future treatment planning.

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#### C.D. MARTIN, C.L. MICHAEL, B.R. WILLIAMS & P.J. DONOVICK. Dementia Rating Scale as a predictor for memory performance.

**Objective:** Characteristics of dementia are highlighted by a variety of forms of memory loss. Even mild dementia would be expected to result in poor performance on memory tasks, thus a low score on the DRS would logically predict a poor performance on the CVLT II. Testing was conducted to establish a relationship between the two tests.

**Participants and Methods:** Subjects ranged in state from non-demented to mildly demented, having been taken from a separate memory study being conducted concurrently. All subjects used were senior citizens, some living independently and others in assisted living centers. The Dementia Rating Scale (DRS) is a screening tool that was developed to assess dementia. The California Verbal Learning Test (CVLT II) is a measure of memory.

**Results:** A powerful positive correlational relationship was established between results from the two tests at a highly significant level. These relationships were established across conditions of the CVLT II, in both short and long delay, and free and cued recall.

**Conclusions:** The results support the DRS as a strong predictive tool for memory loss in senior citizens.

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#### P. MASSMAN & R.S. DOODY. Significance of the Apolipoprotein E $\epsilon 2$ Allele in Alzheimer's Patients' Memory Functioning.

**Objective:** It has been reported that Alzheimer's disease (AD) patients who have an apolipoprotein E  $\epsilon 2$  allele have fewer neocortical plaques and less neurofibrillary pathology than patients without an  $\epsilon 2$  allele. The presence of an  $\epsilon 2$  allele has also been associated with a slower rate of cognitive or episodic memory decline in a small sample of AD patients and in larger samples of non-demented elderly persons.

**Participants and Methods:** We compared the memory and cognitive abilities of probable AD patients with 1)  $\epsilon 2\epsilon 3$  ( $n=40$ ) vs.  $\epsilon 3\epsilon 3$  ( $n=313$ ) genotypes and 2)  $\epsilon 2\epsilon 4$  ( $n=32$ ) vs.  $\epsilon 3\epsilon 4$  ( $n=483$ ) genotypes.

**Results:** The  $\epsilon 2\epsilon 3$  and  $\epsilon 3\epsilon 3$  groups did not differ in demographic characteristics or MMSE scores, but the  $\epsilon 2\epsilon 3$  group obtained significantly higher scores on WMS-R Logical Memory Immediate Recall and Delayed Recall and Visual Reproduction Delayed Recall. The groups did

not differ on non-memory neuropsychological measures. The  $\epsilon 2\epsilon 4$  and  $\epsilon 3\epsilon 4$  groups did not differ in demographic characteristics or MMSE scores or memory test scores. The  $\epsilon 2\epsilon 4$  patients obtained significantly lower WAIS-R Performance IQ scores and made more errors on an attention/mental control test.

**Conclusions:** It appears that the effects of the  $\epsilon 2$  allele (compared to the effects of the  $\epsilon 3$  allele) depend on whether it is paired with an  $\epsilon 3$  or  $\epsilon 4$  allele. If paired with an  $\epsilon 3$  allele, it is associated with better memory functioning, but if paired with an  $\epsilon 4$  allele, there is no memory effect, and possibly mild detriments on a few non-memory neuropsychological measures.

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#### R.E. MCCARTNEY, F.C. GOLDSTEIN, J.J. LAH & A.I. LEVEY. Longitudinal Study of a Patient with the Tau R406W Mutation Causing Progressive Dementia with Bitemporal Atrophy.

**Objective:** Frontotemporal lobar dementia (FTLD) is a heterogeneous group of neurodegenerative disorders encompassing personality changes, language impairment, and less frequently extrapyramidal motor symptoms. The clinical presentation is variable, with some patients presenting primarily with personality and behavioral changes indicative of frontal lobe involvement, and others presenting primarily with language impairment reflecting temporal lobe dysfunction. The R406W mutation in exon 13 is an extremely rare mutation that has been identified in only a handful of families with FTLD. Clinically, the R406W mutation has been characterized by insidious onset and progressive decline in episodic memory, followed by changes in personality and behavior, with increased disinhibition, irritability, impulsivity and loss of social awareness. To our knowledge, this report represents the first in-depth longitudinal workup using cognitive, emotional, and functional neuroimaging data to support the idea that the R406W mutation represents a distinct phenotype.

**Participants and Methods:** The current case study describes the 5 year clinical course of a patient with the R406W mutation, an H1H1 MAPT haplotype and Apolipoprotein E 3/3.

**Results:** The memory profile that emerges in this patient appears to mimic an Alzheimer's disease (AD) profile. Neuroimaging findings indicate dramatic bilateral temporal atrophy visible on both structural and functional measures.

**Conclusions:** Given the AD-like profile these patients demonstrate, it is virtually impossible to accurately diagnose them without the use of genetic testing. These findings support the notion that the R406W mutation does represent a distinct phenotype and highlight the importance of genetic testing for accurate diagnosis and treatment.

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#### R. MCDONALD, A. MYTINGER, A. HULBERT & M. SCHMITTER-EDGEcombe. Analysis of Verbal Fluency in Alzheimer's Dementia.

**Objective:** The current research examines the use of cognitive strategies that have been suggested as components of efficient verbal fluency performance: clustering (i.e., grouping related words) and switching (i.e., changing clusters). To garner additional information about the ability of Alzheimer's disease (AD) patients to utilize these strategies, clustering and switching performance was tracked across successive 30-second intervals.

**Participants and Methods:** Twenty-two patients with dementia of the Alzheimer's type and 22 normal older adults were administered phonemic (FAS) and semantic (Animal) fluency tasks. Clustering and switching were measured across two 30s intervals using a modification of the scoring technique established by Troyer, Moscovitch, and Wincour (1997).

**Results:** As expected, the AD group demonstrated overall reduced verbal fluency compared to controls. The AD group also showed reduced

levels of switching for both tasks and reduced category cluster size for the phonemic fluency task. Both groups produced more correct responses and demonstrated a higher rate of switching during the first 30s interval. Both groups also demonstrated a significant increase in cluster size from the first 30s interval to the second 30s interval for the phonemic fluency test. In contrast, for the semantic fluency task, cluster size remained at an equivalent level across time intervals.

**Conclusions:** Although the AD group produced fewer total responses, the pattern of responding was similar for groups across the time intervals assessed, suggesting similar strategy use. The increased cluster size for the phonemic fluency task may reflect the use of a more strategic retrieval search once initial phonemic responses have been produced.  
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**J.C. THOMPSON, C.A. NOGGLE & M.T. BARISA. Predictability of Outcomes on the Independent Living Scale Based on RBANS Subtest Performance in a Sample of Patients with Cortical-Based Dementing Disorders.**

**Objective:** The current investigated the extent to which outcomes on the ILS appear related to and/or dependent upon performance measured by RBANS subtests in a sample of patients diagnosed with cortical-based dementing presentations.

**Participants and Methods:** An archival data set was used for the current study. Participants included 18 individuals diagnosed with a variety of cortical-based dementias who were administered both ILS and RBANS as part of a comprehensive neuropsychological evaluation. RBANS subtest scores and ILS outcome scores were analyzed.

**Results:** Canonical correlation revealed isolated relationships between ILS domains and individual subtests of the RBANS. Those noted included significant relationships between the figure copy ( $r=.566$ ), line orientation ( $r=.552$ ), and semantic fluency ( $r=.541$ ) subtests of the RBANS and ILS-Managing Home & Transportation. An additional significant relationship was noted between ILS-Health & Safety and line orientation ( $r=.543$ ). No additional correlations met significance.

**Conclusions:** Results are of importance as they appear to contrast those findings of (Noggle et al., 2008), which demonstrated a stronger and more robust link between RBANS indices and ILS outcomes. Thus, while current findings demonstrating isolated relationships are interesting, current results are of greater importance in that they suggest utilization of individual subtests may not be extended to judgments of capacity, rather as demonstrated by (Noggle et al., 2008), a more broad interpretation of RBANS indices may be more reliable.

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**A.M. SEELYE, J. FLORES & M. SCHMITTER-EDGECOMBE. Episodic Memory Predictions in Persons with Amnesic and Non-amnesic Mild Cognitive Impairment.**

**Objective:** This study examined memory self-awareness and memory self-monitoring in participants with amnesic and non-amnesic MCI.

**Participants and Methods:** Twenty-seven individuals with amnesic MCI, 14 individuals with non-amnesic MCI, and 41 controls completed a performance prediction paradigm. To evaluate memory self-awareness, participants predicted the number of words they would remember before completing a list-learning memory task. To evaluate memory self-monitoring, participants' ability to increase the accuracy of their predictions after experience with the task was examined.

**Results:** As expected, participants with amnesic MCI demonstrated poorer recall for the word list than controls and participants with non-amnesic MCI ( $p < .001$ ). Participants with amnesic MCI also predicted that they would recall less information than controls and were as accurate as controls in their memory predictions. Participants with non-amnesic MCI were less accurate in their memory

predictions than both amnesic MCI participants and controls ( $p < .05$ ). This, however, reflected the fact that the non-amnesic MCI participants under-estimated their true list-learning performances. Similar to controls, both MCI groups successfully modified their memory predictions so that they were more accurate following task exposure.

**Conclusions:** Individuals with amnesic and non-amnesic MCI demonstrated accurate metamemory, which may facilitate ability to benefit from targeted behavioral interventions focused on utilizing compensatory strategies for everyday memory problems.

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**P. DEMIREVA & J. SUHR. Primacy, But Not Recency, Is Related To Executive Functioning In Older Adults Screened For Dementia.**

**Objective:** Given the importance of early detection of Alzheimer's disease (AD), it is vital to identify markers of early neuropsychological decline. Learning and memory decline has long been identified as an indicator of AD, with some studies demonstrating that reduced primacy, but not recency, on a word list learning task is particularly useful as an early indicator of pathological cognitive decline. In addition, recent studies have demonstrated the importance of executive functioning impairment in distinguishing those with "benign" memory changes from those who show progressive cognitive decline consistent with AD. The present study examined the relationship between primacy and recency performance and executive functioning in 39 older adults seen for dementia evaluation in an outpatient geriatric medicine clinic.

**Participants and Methods:** The sample ranged in age from 64 to 95 years (mean 79.3) and had between 7 and 20 years of education (mean 13.5 years); 9 participants were male.

**Results:** Despite not being used in diagnostic decisions, performance on the primacy part of a word list was significantly worse in those diagnosed with dementia relative to those not diagnosed with dementia ( $p < .001$ ), while recency performance did not differ ( $p = .13$ ). In the whole sample, primacy was significantly related to tests of working memory skills, semantic and verbal fluency, and trail making part B ( $r$ s ranged from .36 to .79), while recency was not ( $r$ s = .23 to .35).

**Conclusions:** Overall, results suggest that poor primacy performance is strongly related to dementia diagnosis and to poor executive functioning in older adults being assessed for dementia.

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**N. TORRENCE, S. BAYAN, T. CLAYCOMB, J. WONG & J. RAZANI. Using Neuropsychological Performance to Predict Daily Functional Abilities in Patients with Alzheimer's Disease.**

**Objective:** The utility of neuropsychological test for assessing and diagnosing dementia is well established. The purpose of this study was to assess how well neuropsychological test scores predict functional ability in patients with Alzheimer's disease.

**Participants and Methods:** 30 patients with Alzheimer's disease participated and were administered a battery of neuropsychological test. For this project we concentrated on six tests measuring various domains of cognitive functioning such as memory (CVLT-II and Rey-O savings scores), executive functioning (WCST and D-KEFS Tower test), visuospatial abilities (Rey-O copy) and language (FAS and BNT). Functional ability was measured with the Direct Assessment of Functional Status (DAFS) test. The DAFS is an observation-based task which measures domains such as communication, time orientation, shopping abilities, knowledge of transportation rules and signs, and financial skills.

**Results:** Stepwise regression analyses were used to predict each DAFS domain from neuropsychological test scores. Specifically, executive functioning and memory tasks accounted for 61.3 percent of the variance of DAFS orientation scores. Language and executive functioning tasks

accounted for 55.3 percent of the variance of DAFS communication performance and 56.1 percent of the variance of DAFS financial performance. The visuospatial test accounted for 41.6 percent of the variance of DAFS transportation performance. Furthermore, executive functioning, language and memory tasks accounted for 79.3 percent of the variance of DAFS shopping functionality.

**Conclusions:** Results demonstrated that neuropsychological tasks are indeed accurate predictors of functionality in participants with Alzheimer's disease. These findings lend ecological validity to neuropsychological tests and are useful information for treatment planning. Correspondence: *Nicole Torrence, California State University Northridge, 2925 W Rosecrance #3, Gardena, CA 90249. E-mail: ndt29142@csun.edu*

**K.L. VOTRUBA, C. PERSAD, J. HEIDEBRINK, N. BARBAS & B. GIORDANI. Patient Mood and Instrumental Activities of Daily Living in Alzheimer's Disease: Relationship between Patient and Caregiver Reports.**

**Objective:** Depressed mood is commonly reported in patients with Alzheimer's disease. These data are often gathered from patient self-reports or caregiver responses. However, concerns have been raised about the accuracy of dementia patients' self-perceptions. Additionally, caregivers' beliefs are often affected by patients' cognitive deficits. There is little research examining the relationship between these two sources of information and their ability to predict aspects of daily functioning. This study investigated the relationship between self-reported depressive symptoms and caregiver perceptions of patient depression, as well as the ability of these reports to predict a patient's ability to perform instrumental activities of daily living.

**Participants and Methods:** Participants included 124 patients with mild Alzheimer's disease ranging in age from 52 to 90 years ( $M = 72.1$ ,  $SD = 10.0$ ). The educational level varied from 6-20 years ( $M = 14.2$ ,  $SD = 3.2$ ) and MMSE scores ranged from 17-23 ( $M = 19.8$ ,  $SD = 1.9$ ).

**Results:** Results showed that self-reported scores on the Geriatric Depression Scale (GDS) were not significantly related to caregiver reports of patient's depressive symptoms as measured by the CERAD Behavior Rating Scale for Dementia ( $r = .17$ ;  $p = .115$ ). Nevertheless, multiple regressions revealed that GDS scores predicted a significant amount of variance in performance of instrumental activities of daily living ( $p = .006$ ) and caregiver reports predicted a strong trend in this regard ( $p = .059$ ).

**Conclusions:** Although it appears that patient and caregiver reports may be measuring different aspects of depression, both may contribute uniquely to the characterization of functional impairment.

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**J.T. WONG, S.M. BAYAN, N.D. TORRENCE & J. RAZANI. Changes in Daily Functional Abilities of Patients with Alzheimer's Disease.**

**Objective:** The purpose of the present study was to investigate changes in the daily functional abilities of patients with Alzheimer's disease (AD) over a one year period using an observation-based measure of activities of daily living.

**Participants and Methods:** 20 patients with AD and 26 age- and education-matched normal controls participated. All participants were administered the Direct Assessment of Functional Status (DAFS) on two different occasions (separated by 12 months). The DAFS is an observation-based activities-of-daily living task that assesses multiple domains of functioning. We were interested in the time orientation, communication skills, the ability to recognize and utilize transportation rules, financial skills, and shopping capabilities subscales.

**Results:** Difference scores were created for all participants for the 5 DAFS subscales by subtracting year 1 from year 2 scores. The results of a 2 (group) x 5 (DAFS domain) MANOVA revealed an interaction between group x DAFS domain ( $p = .04$ ). One-way ANOVAs revealed that

the AD group's performance declined over time on all but the transportation DAFS subscale relative to the control group (all  $p$  values  $< .05$ ). While not statistically significant, the shopping task appears to display the greatest decline over the one year period in the AD patients relative to the other subscales.

**Conclusions:** These findings are useful because 1) they demonstrate that the DAFS is a useful measure for tracking functional decline over time and 2) the DAFS maybe a useful measure for healthcare professionals to use when planning treatment of AD patients.

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**K.Z. YAMOUT, F.C. GOLDSTEIN, A.V. ASHLEY, J.J. LAH & A.I. LEVEY. Vascular Comorbidities and Cognitive Progression of Alzheimer's Disease.**

**Objective:** Vascular comorbidities (VCs) have been identified as risk factors for Alzheimer's disease (AD), but it is unclear whether VCs affect progression once AD is clinically manifest. We hypothesized that an increase in the number of VCs would be associated with greater cognitive decline.

**Participants and Methods:** A chart review was conducted of 93 probable AD patients followed in the Neurology Memory Disorders Clinics. Patients received tests of cognitive status (MMSE), attention (Digit Span, Trails A), episodic memory (CERAD Word List), semantic fluency (Animals) and executive functioning (Clock). Patients were re-evaluated an average of 14.3 ( $SD=3.9$ ) months. Hypertension, diabetes, and hypercholesterolemia were defined as present via report, measurement, and/or medication usage.

**Results:** Repeated measures ANOVAs of the cognitive scores at baseline versus follow-up revealed comparable declines for patients with none, one, two, or three VCs for all tests except the MMSE which showed the greatest decline for patients with 0 VCs. Multiple regression analyses of the change scores, controlling for age, education, race, and follow-up interval, revealed a similar pattern for the MMSE score to decline with decreasing numbers of VCs. Changes on the other cognitive tests were not affected by number of VCs.

**Conclusions:** We did not observe significant associations between an increase in the number of VCs and greater cognitive decline. The relationship between fewer VCs and a decline in the MMSE score was unexpected. Biomarkers such as endothelial dysfunction or cerebral white matter damage detected via neuroimaging may provide a more sensitive marker of chronic vascular disease in future studies.

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**R.F. ZEC, R. JAKUBOWSKI, S.J. MARKWELL & N.R. BURKETT. Constructional Praxis as Measured by the Complex Figure Copy in AD and MCI Patients Compared to Demographically-Matched Controls.**

**Objective:** The objective was to determine the degree of impairment on the Rey-Osterreith Complex Figure Test (CFT) copy in groups of patients with possible and probable Alzheimer disease (AD) (mild dementia) and Mild Cognitive Impairment (MCI) relative to demographically-matched controls.

**Participants and Methods:** There were 23 MCI patients, 47 possible AD patients, and 98 probable AD patients, and three demographically-matched control groups (matched on age, education, and gender). The two AD groups are mildly demented (mean MMSE=25) and had a mean age of 74 years and mean education of 12.3 and 12.5 years, respectively. The MCI group had a mean MMSE of 28.2, age 78.3 years, and education 12.9 years. Each subject was administered the CFT copy and the MMSE.

**Results:** Possible AD and Probable AD groups had similar mean CFT scores (23.6, 23.7) and were significantly lower than the mean CFT

scores of their respective control groups (29.6, 30.3). The MCI group was slightly but non-significantly lower than its control group (28 vs. 29.8). The z-score in comparing the patient groups with their respective control groups were -1.51 for the Probable AD group, -1.27 for the Possible AD group, and -0.43 for the MCI group.

**Conclusions:** The possible and probable AD patient groups with mild dementia, but not the MCI group, displayed significantly lower CFT scores than their demographically-matched control groups. The magnitude of the difference between the probable AD group and its control group was moderately large, i.e., z-score=-1.51, mean 6.7-point difference on the 36-point scale, and 22% lower mean score.

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### Dementia (Subcortical, Specific Disorders, MCI, etc.)

#### M. AMICK, J. GRACE, S. QUELLER & J. STOUT. Dopaminergic Medication Dose Impacts Probabilistic Reversal Learning.

**Objective:** The impact of dopaminergic (DA) medications compared to disease severity on reversal and sequence learning was examined in Parkinson's disease (PD). Reversal learning is thought to be processed by the orbitofrontal cortex (OFC), whereas sequencing learning engages the dorsolateral prefrontal cortex (DLPFC). According to the DA overdose hypothesis, OFC functions are disrupted (overdosed) by DA medication because the OFC-ventral striatum circuit is unaffected until late PD stage. By contrast, the DLPFC, a brain region functionally deaf-ferentated by early disease-related DA loss in the dorsal striatum, is remediated by DA medications. This study addressed a confound in previous studies of the DA overdose hypothesis: disease severity and medication dose. Given the DA overdose hypothesis, we predicted that disease severity (in patients treated with equivalent DA doses) would not affect performance on either learning task, whereas reversal learning would be selectively affected with high but not low dose DA treatment.

**Participants and Methods:** Computer administered reversal learning and sequencing learning tasks were compared in PD patients on high (n=17) or low DA doses (n=19) and at early (n=16) or later (n=18) Hoehn and Yahr disease stage.

**Results:** The high DA compared to low DA dose group tended to learn the reversal less frequently (p=.098), made more errors learning the reversal (p<0.03), and had slower reaction times post reversal (p=0.02). No other group differences were observed.

**Conclusions:** DA medication affected reversal learning in PD patients matched for disease severity, providing further support for the DA overdose hypothesis.

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#### R. CORREIA-PASSINHAS, J. BARROSO, A. NIETO, D. FERREIRA & M. SABUCEDO. Operationalizing aMCI Amnesic Criterion.

**Objective:** MCI concept remains controversial. Most of the criticism is based on the follow up results of longitudinal studies, but in our opinion, the key problems are in a previous stage: the MCI diagnosis. In this way, we aimed to explore how modifications in the operationalization of aMCI criteria (by using different instruments for the assessment of the memory impairment), could have an effect on the distribution of Normal/MCI rate in a population sample.

**Participants and Methods:** 77 old participants, 47 women and 30 men, underwent the MMSE and CVLT. Distributions of the Normal vs aMCI classification according to the results in memory items from MMSE and CVLT were compared.

**Results:** When comparing the whole sample there are no significant differences between the MMSE y TAVEC distributions of the Normal and aMCI participants ( $X^2(3) = 2.719$ ;  $p = 0.437$ ) and there is no correla-

tion between performance in both tests ( $r_s = -0.022$ ;  $p = 0.846$ ). Discarding the non-congruent participants, we got significant differences between the distributions, showing that 27% of participants were diagnosed with MCI according to TAVEC, whereas only 6% of participants got this diagnostic when MMSE was administered ( $X^2(3) = 11.806$ ;  $p < 0.01$ ;  $r_s = 0.355$ ;  $p < 0.01$ )

**Conclusions:** Results show how different operationalizations of the memory impairment criterion modify the distribution of normal/aMCI subjects in a population, and offer an alternative and complementary explanation to the lack of consistency among follow up studies. Thus, we claim for the need of agreement beyond the MCI consensus criteria (Winblad et al. 2004).

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#### H. ÁLVAREZ, A. NIETO, J. BARROSO, D. FERREIRA & R. CORREIA-PASSINHAS. Mild Cognitive Impairment (MCI): Differences in Qualitative Aspects Between Patients With and Without Verbal Fluency Impairment.

**Objective:** Previous research has shown that MCI patients might have word generation impairment assessed through verbal fluency tasks. We aim to study if verbal fluency impaired and unimpaired MCI patients differ in the use of strategies of clustering and switching.

**Participants and Methods:** 30 MCI patients were assessed. They were given a Phonemic Fluency task (PF) and a Semantic Fluency task (SF). We used Troyer's (2000) method to define cluster (two or more consecutive words belonging to the same category) and switches (number of transitions between cluster, including single words). In addition, we used the number of clusters as a complementary measure of cognitive flexibility.

**Results:** 30% MCI patients were impaired in the PF task and 60% were normal. The impaired group generated significantly less number of switches, number of clusters and isolated words. There were no differences in cluster size. 43% MCI patients were impaired in the SF task and 57% were normal. The impaired group generated significantly less number of switches and number of clusters. There were no differences in cluster size, isolated words.

**Conclusions:** The incidence of fluency impairment in MCI patients is similar in both phonemic and semantic tasks (30%-43%). In addition, the pattern of results is similar in both tasks: impaired MCI generated less clusters and switched less often than preserved, while clustering did not discriminate the patients groups. Results suggest that the word generation deficits in MCI are more related to a lack of cognitive flexibility than to an alteration in semantic system.

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#### D. FERREIRA, J. BARROSO, A. NIETO & R. CORREIA-PASSINHAS. Cognitive Impairment Characterization and Follow-up in Mild Cognitive Impairment Multiple-Domain Subtypes (MCI-MD).

**Objective:** Our purpose was to describe the pattern of cognitive impairment in multiple-domain MCI subtypes and its progress in the follow-up.

**Participants and Methods:** Following clinical criteria participants were classified as amnesic MCI MD (13) or as non amnesic MCI MD (15). Both groups were comparable in age, education and sex. Participants were assessed with an exhaustive neuropsychological protocol. Results were interpreted according to standardized scores or normative data. 18 patients were reassessed (6 patients with a-MCI MD and 12 patients with na-MCI MD). The mean follow-up interval was 26.22 months (SD: 8.26).

**Results:** Taking the whole sample, executive functions were the most affected (93%) followed by premotor functions (61%). Attention impairment and cognitive slowing were more frequent in na-MCI MD (73%) than in a-MCI MD (46%). The rest of functions were affected lower than 30% of participants. Follow up results showed that executive functions



were still being the most affected (89%). Impairment in premotor functions, cognitive slowing and visuospatial functions increased with respect to baseline (78%, 78% and 50% respectively). Participants also reported significant more changes in personality and behavior. The rest of functions remained stable.

**Conclusions:** Visuospatial functions, praxis, perception, language skills are the more preserved cognitive domain in MCI-MD. Both multidomain subtypes shared frontal affectation, with larger predominance of the cortical-subcortical type in na-MCI MD. After follow up, we observed an increase in the incidence of impairment in processing speed, premotor and visuospatial functions. Prefrontal functions continue to be the more affected domain, both in cognitive and behavioral-emotional aspects.

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**P.L. BRITNELL, L. BRENNAN, E. ROSENTHAL, C. FAVINGER, M. GROSSMAN, D.J. LIBON, A. SIDEROWF & T. GIOVANNETTI. The Impact of Cognitive Impairment on Everyday Functioning in Parkinson's Disease.**

**Objective:** The nature of everyday dysfunction in Parkinson's disease (PD) has not been well characterized. PD participants were compared to healthy controls on a performance-based test that evaluates everyday difficulties due to cognitive failures.

**Participants and Methods:** Eighteen participants with PD and no dementia were compared to 16 healthy controls on the Naturalistic Action Test (NAT). The NAT does not penalize participants for motor imprecision/slowing. Performances were videotaped and 4 variables were coded: NAT score- a composite of accomplishment and errors; Accomplishment- percent of central task steps accomplished; Total Errors-number of errors committed. Error patterns also were analyzed, including the proportion of errors that were commissions (i.e., inaccurate execution of a step) versus omissions (i.e., failure to execute a step). A neuropsychological evaluation was administered to all PD participants.

**Results:** NAT scores showed only 2/18 PD participants performed in the impaired range on the NAT; no controls performed within the impaired range. PD and control participants did not differ significantly on NAT Accomplishment ( $M = 96\%$  vs.  $99\%$ ) or Total Errors ( $M = 4$  vs.  $2$ ). Relative to controls, PD participants showed a higher proportion of omissions ( $M = 36\%$  vs.  $10\%$ ;  $z = 2.02$ ,  $p = .07$ ) and a significantly lower proportion of commissions ( $M = 36\%$  vs.  $85\%$ ;  $z = 3.05$ ;  $p < .01$ ). Among PD participants, Total Errors correlated significantly with caregiver reports of ADL/IADL ( $r_s = .62$ ) and tests of global impairment ( $r_s = -.50$ ) and episodic memory ( $r_s = -.47$ ).

**Conclusions:** PD is associated with only mild everyday difficulties due to cognitive failures. These mild difficulties are characterized by omission of non-central component steps, as overall task accomplishment remained preserved. Furthermore, action difficulties may be more strongly related to overall level of impairment and episodic memory than executive functioning abilities.

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**P. BRITNELL, C. FAVINGER, L. BRENNAN, E. ROSENTHAL, A. SIDEROWF, D.J. LIBON, M. GROSSMAN & T. GIOVANNETTI. Everyday Functioning in Alzheimer's Disease versus Dementia due to Parkinson's Disease.**

**Objective:** Relative to other cognitive processes (e.g., memory executive control), problems in everyday functioning have not been carefully evaluated across different dementia syndromes. This pilot study compared performance on several everyday tasks between participants with Alzheimer's disease (AD) and those with Parkinson's disease dementia (PDD).

**Participants and Methods:** Nine people with mild/moderate AD and 13 people with mild/moderate PDD were administered the Naturalistic Action Test (NAT), a performance-based measure that includes three

tasks that differ in various ways (e.g., number of sub-goals, presence/absence of distractor objects, etc.). Task accomplishment and a range of errors were coded, but performance was not penalized for motor slowness/imprecision. Caregiver reports of everyday functioning also were collected.

**Results:** The groups did not differ in age, education, or general dementia severity. There was a trend for AD caregivers to report more functional impairment than PDD caregivers ( $23.34$  vs.  $28.20$ ;  $t = 1.80$ ,  $p = .09$ ). However, the groups did not differ on NAT total errors ( $18.68$  vs.  $21.11$ ). A comprehensive analysis of NAT performance showed that AD participants demonstrated a tendency for a greater proportion of omission errors than PDD patients ( $64\%$  vs.  $59\%$ ), whereas PDD patients showed a tendency for a greater proportion of off-task errors ( $12\%$  vs.  $8\%$ ). PDD patients also showed higher rates of errors than AD patients when salient distractor objects were present ( $3.23$  vs.  $1.67$ ).

**Conclusions:** Distinct patterns of everyday action impairment in PDD and AD participants appear to reflect group differences in susceptibility to interference from distractors (i.e., executive control) and the ability to complete task steps (i.e., possibly episodic memory or task knowledge). These findings are consistent with prior studies comparing AD to subcortical vascular dementia and will be discussed in reference to a preliminary neuropsychological model for everyday action impairment in dementia.

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**Y.L. CHANG, A.J. JAK, L. DELANO-WOOD, A. MCCAULEY, D.C. DELIS & M.W. BONDI. Analysis of Qualitative and Quantitative Features of Verbal Fluency in Healthy Aging, Mild Cognitive Impairment, and Alzheimer's Disease.**

**Objective:** We evaluated quantitative (word generation) and qualitative (category clustering and switching) aspects of verbal fluency in discriminating healthy aging, mild cognitive impairment (MCI), and mild Alzheimer's disease (AD). Given evidence of degradation in semantic system in AD and MCI, we expected these patient groups to show reduced cluster sizes, particularly in category fluency. Furthermore, we predicted that switching (i.e., the ability to shift between subcategories) would be related to executive functioning.

**Participants and Methods:** Tests of letter and category verbal fluency were administered to 44 healthy elderly, 24 MCI, and 15 mild AD as part of a comprehensive neuropsychological assessment. Groups were matched on age and education. Three scores were obtained on each fluency test: (1) total number of words generated; (2) mean cluster size; and (3) number of switches.

**Results:** Findings showed a significant group effect on the total number of words generated and the number of switches on both types of fluency (i.e., healthy elderly =  $MCI > AD$ ). Furthermore, healthy elderly and MCI significantly differed on the mean cluster size of the category fluency, and MCI did not differ from AD. Switching variables were significantly correlated with several executive function measures.

**Conclusions:** The semantic system may be compromised in MCI given our findings of decreased cluster size on category fluency. However, dissimilar to AD, individuals with MCI were able to compensate for performance decrements by switching due to relative intact executive functioning, resulting in a comparable total number of word generated with healthy aging. Our findings suggest that the combination of quantitative and qualitative analyses of verbal fluency may be useful in differentiating healthy aging from MCI or AD.

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**S.K. CHESTER, K. POSSIN, V. LALUZ, B. MILLER & J. KRAMER. The Neural Correlates of Design Fluency Repetition Errors and Implications for the Diagnosis of Frontotemporal Dementia.**

**Objective:** Although repetition errors are commonly observed in evaluations, they are not clinically or neuroanatomically well understood. To address this, we studied the neural correlates and diagnostic group differences of repetition errors on the D-KEFS Design Fluency Test (DFT).

**Participants and Methods:** The sample consisted of 238 individuals diagnosed with neurodegenerative disease or as neurologically healthy. Partial correlations were performed between repetition errors made on the DFT and bilateral frontal, parietal, and temporal gray matter volumes, controlling for total intracranial volume and Mini Mental State Exam scores. A semi-automated parcellation program (Freesurfer) was used to analyze 1.5T structural MRI scans. We also compared AD, FTD, MCI and normal control subjects on repetition error scores with a One-Way ANOVA.

**Results:** Errors only correlated with frontal volumes (right frontal:  $r = -.274, p = .002$ ; left frontal:  $r = -.219, p = .017$ ). To examine which frontal subregions were most highly associated with repetition errors, partial correlations were carried out with left and right lateral prefrontal cortex (LPFC), orbitofrontal cortex (OFC), and anterior cingulate cortex (ACC). Significant correlations were found with right OFC ( $r = -.26, p = .001$ ), left OFC ( $r = -.23, p = .001$ ), right LPFC ( $r = -.18, p = .009$ ), and right ACC ( $r = -.17, p = .014$ ). One-way ANOVA with Tukey post-hoc indicated that FTD patients made more repetition errors than Normal Controls ( $p = .001$ ) or patients with AD ( $p = .022$ ) or MCI ( $p = .031$ ). The other groups did not differ on repetition error commissions.

**Conclusions:** These results highlight the critical role of the frontal lobes in preventing repetition errors, and suggest that the right PFC as well as the bilateral OFC may be particularly crucial in the prevention of these errors. Three of the four associated regions were on the right, which is consistent with the literature. Furthermore, the results suggest that Design Fluency repetitions may be useful in the differential diagnosis of FTD. Correspondence: *Serana K. Chester, MS, Memory and Aging Center, Neurology, University of California, San Francisco, 350 Parnassus Ave, San Francisco, CA 94143. E-mail: schester@memory.ucsf.edu*

**J.N. COPELAND, R. GRIFFITH, T. O'BRIEN & D. MARSON. Clock Drawing in Parkinson's Disease Dementia and Alzheimer's Disease.**

**Objective:** This study examined differences between clock drawing ability in patients with Parkinson's disease dementia (PDD) and patients with Alzheimer's disease (AD). We predicted PDD patients would perform worse than AD patients on clock drawings as a result of greater motor, executive, and visuospatial impairment.

**Participants and Methods:** Twenty-five PDD patients, matched demographically with 25 AD patients and 25 normal controls, completed the command (Clox 1) and copy (Clox 2) conditions of a clock drawing task, Clox, (Royall 1998) as part of a larger neuropsychological battery.

**Results:** MMSE and DRS scores did not differ between PDD and AD patients, but both groups performed below controls. One-way ANOVAs revealed between group differences on Clox 1,  $F(2,72) = 22.98, p < .001$ , and Clox 2,  $F(2,72) = 17.71, p < .001$ . Post hoc tests showed that PDD patients performed worse than AD patients on Clox 1 and 2. Using a rating scale of motor dysfunction as a covariate, PDD and AD patients no longer differed on Clox 1 and 2, although both groups remained significantly below controls. PDD patients' clock drawing performance related to processing speed and attention, whereas AD patients' performance related to executive function and working memory.

**Conclusions:** After accounting for motor dysfunction in PDD, the difference between the command and copy conditions of clock drawings did not differ in PDD patients and AD patients. However, different cognitive processes may underlie impaired scores in these groups. A qualitative approach and detailed analysis of errors should be further explored. Correspondence: *Jacquelyn N. Copeland, B.S., Psychology, University of Alabama at Birmingham, 1530 3rd Avenue South, CH 415, Birmingham, AL 35294. E-mail: jcopeland@uab.edu*

**M.E. COTTINGHAM & K.A. HAWKINS. Verbal Fluency Deficits Correlate with Memory Deficits in Non-Demented Patients with Memory Complaints: Implications for the Concept of Mild Cognitive Impairment.**

**Objective:** We tested the notion that patients at high risk for progression to Alzheimer's disease (AD) would display relatively isolated memory deficits by assessing the relationship between memory and fluency performances.

**Participants and Methods:** The sample consisted of 92 participants with cognitive complaints and borderline to mild clinical presentations. Patient groups were formed on the basis of performance on formal memory tests.

**Results:** Patients with normal memory scores performed at significantly higher levels on verbal fluency tests than patients with uniformly low memory performances. Whereas the fluency performances of the normal memory group were also normal, the fluency performances of the memory impaired group were deficient. Patients falling between these two groups displayed fluency scores consistent with their intermediate memory performances. Consistent with findings in AD, whereas the normal memory group performed at equivalent levels on semantic and phonemic fluency tasks, both the impaired memory group and the intermediate group displayed relatively greater weaknesses in semantic fluency.

**Conclusions:** These findings suggest that memory deficits in "pre-clinical" AD are likely to be accompanied by fluency weaknesses. The implications for diagnostic criteria for mild cognitive impairment are discussed.

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**S.A. CREAMER & M. SCHMITTER-EDGEcombe. Narrative Comprehension in Mild Cognitive Impairment: Assessing Inferences and Memory Operations with a Think-aloud Procedure.**

**Objective:** To gain a better understanding of text comprehension abilities in Mild Cognitive Impairment (MCI), a think-aloud protocol was used to examine what information (from the prior text and world knowledge) is consciously available in working memory during narrative comprehension.

**Participants and Methods:** Twenty-three MCI participants and 23 healthy older adults talked aloud after they read each sentence of story narratives. Factual and inferential questions about each narrative were also answered. Participant's utterances were coded for the production of inferential and non-inferential clauses and the memory operations that supported inferential clause production (Trabasso & Magliano, 1996).

**Results:** Analyses revealed that the MCI group generated proportionately fewer inferential statements,  $F = 6.14, p < .02$ , produced proportionately fewer explanatory inferences,  $F = 7.88, p < .01$ , and relied less on prior text,  $F = 9.93, p < .005$ , as a memory source for the production of inferences. The MCI group also answered fewer inferential and factual questions about the text correctly,  $F's > 4.2, p < .05$ .

**Conclusions:** The pattern of findings suggests that when comprehending text the MCI participants produced fewer inferences, had poorer access to prior text information, and focused less on explaining events in the story. Moreover, the MCI group demonstrated poorer comprehension for both explicitly stated and implied information from the stories. These findings indicate that the MCI group's cognitive difficulties are interfering with both their ability to rely on episodic memory and to utilize effective inferential strategies to aid in their comprehension of narratives.

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**G.P. CRUCIAN, P.S. FOSTER, D.W. BURKS, S.J. ARHMAGHANI, V. DRAGO, M.S. OKUN & K.M. HEILMAN. Disturbance in Spatial Representation in Parkinson's Disease.**

**Objective:** Parkinson's disease (PD) is frequently associated with attenuated movement amplitude, including shuffling gait, reduced arm swing, hypomimia, and micrographia. Studies have also shown that PD patients have difficulties estimating size and distance. These findings suggest that PD induces a disturbance in spatial representations that alters perception and knowledge of size and distance between objects in the environment.

**Participants and Methods:** Fifteen nondemented PD participants and 10 demographically similar volunteers estimated a six-inch movement with their dominant (right) hand, followed by their nondominant hand. Participants were blind-folded to minimize visual feedback. To assess effects of direction on distance estimation and movement, participants moved randomly from a fixed center point in four different directions along X-Y coordinates. Testing was repeated two months later in 14 PD and 6 control volunteers to assess effects of dopamine medications and practice.

**Results:** Within subject group comparisons revealed no effect for dopaminergic medication or repeated testing. Repeated measures ANOVA on nondominant hand data found no differences between groups in distance estimation. However, repeated measures ANOVA on dominant right hand data revealed PD participants significantly underestimated target distance compared to control volunteers. All participants underestimated target distance.

**Conclusions:** It remains unclear if this deficit is related to kinaesthetic misperception, hypometric representations, or motor programming deficits. Because levodopa did not influence the hypometria of these PD patients, other neurotransmitter systems or neuronal dysfunction might account for these deficits. The reason why this deficit was limited to the left hemisphere-right hand is also remains unclear and warrants further research.

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#### A. DOODY, J. RIVEST & L. LEACH. Selective and divided attention, within and between the visual and auditory modalities, of individuals aging with mild cognitive impairment.

**Objective:** Selective and divided attention, within and between the visual and auditory modalities, of individuals aging with mild cognitive impairment (MCI) was compared to that of healthy controls (HC).

**Participants and Methods:** The recently developed assessment battery that utilizes the flanker paradigm—the Baycrest Attention Test—was used to measure accuracy of responses, speed and variability of reaction time (RT) at these numerous attention tasks. With age and education matched, 17 MCI and 24 HC were tested. Cognitive status was assessed using scales of the Weschler Abbreviated Scale of Intelligence and the Kaplan-Baycrest Neurocognitive Assessment.

**Results:** Within audition, MCI did not differ from HC except that they were slower when dividing attention. Within vision, MCI were slower and less accurate in selective attention, but they were the worst (slower, more variable and less accurate) when attention was divided. Dividing attention between the two modalities did not hinder MCI as much as dividing it within vision: While their RT was more variable, on average it was not different from that of HC and their responses were not less accurate.

**Conclusions:** The results show that the attention difficulties of MCI are most severe when attention is divided within the visual domain. Results are discussed in light of processing complexity of tasks, possible visual perceptual deficit, reduced scope of attention, and deficit in disengaging visual attention in MCI. The importance of doing more thorough assessment of different types of attention in the clinical evaluation of the aging population is also discussed.

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#### J.S. EPPIG, G. WICAS, D.J. LIBON, C. LIPPA, B. BETTCHER & T. GIOVANETTI. An Agnostic Approach to Mild Cognitive Impairment.

**Objective:** This study evaluated the incidence of mild cognitive impairment (MCI) among a sample of non-demented older adults who presented to a memory disorders clinic with self-reported cognitive complaints. Neuropsychological protocols of MCI patients were examined for differential patterns of cognitive impairment.

**Participants and Methods:** 88 patients with MMSE scores  $\geq 24$  were evaluated with neuropsychological tests of executive control, lexical retrieval, and declarative memory. A diagnosis of MCI was assigned to patients if performance on any test fell  $\leq 1.5$  sd units below age norms and ADL/IADL functioning was intact. Neuropsychological data from MCI participants was subjected to a cluster analysis.

**Results:** 73 of 88 patients met criteria for MCI. The cluster analysis arranged patients into three groups: amnesic (AMN;  $n=12$ ), dysexecutive (DYS;  $n=20$ ), and mixed impairment (MIXED;  $n=41$ ). The groups did not differ in age, education, or MMSE scores. The AMN group displayed poor performance on delayed free recall/recognition tests compared to other groups ( $p<.001$ ). The DYS group scored lower on executive tests compared to other groups ( $p<.001$ ). The MIXED group was variable, with 20 patients presenting with single-domain MCI and 21 patients presenting with multi-domain MCI.

**Conclusions:** These data show that impairment on executive or memory tests underlies MCI in some patients. Furthermore, MCI is actually highly nuanced, as most MCI patients present with deficits in multiple domains of neuropsychological functioning. Future studies should focus on how MCI subtypes differ in terms of underlying medical problems, course, and treatment outcome.

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#### E.M. FINE, D.C. DELIS, B.M. PAUL, M. LESUER-MANDERNACK, D.M. SCHIEHSER & J.V. FILOTEO. Reduced Verbal Fluency For Proper Relative to Common Nouns in Parkinson's Disease.

**Objective:** Accumulating evidence from cognitive neuropsychology suggests that retrieval pathways for common nouns (e.g., animals) and proper nouns (e.g., names) can be dissociated, reflecting differences in their cerebral organization. This study compared performance on animal and first-name fluency tasks in non-demented Parkinson's patients (NDPD) and demographically matched healthy participants (HP). We hypothesized that the NDPD group would show disproportionate impairment in generating first names, because retrieval of first names requires the use of novel search strategies that are less dependent on semantic networks.

**Participants and Methods:** 40 NDPD and 40 matched HP were administered the D-KEFS Verbal Fluency Test, which includes animal and first-name fluency. A repeated measures ANOVA (between subjects factor of group, within subjects factor of fluency task), was used to test the hypothesis that the NDPD group would show disproportionate impairment in first-name relative to animal fluency.

**Results:** The ANOVA yielded a significant group X fluency task interaction. Follow-up tests indicated that, while the NDPD group performed significantly worse than the HP group on both animal and first-name fluency tasks, the NDPD group was disproportionately impaired generating first names relative to HPs. After matching the groups on the Dementia Rating Scale, significant group differences were observed only for first-name fluency. Lastly, qualitative analyses of the names generated on the first-name fluency task indicated that the NDPD group produced significantly fewer names within phonological/alphabetical clusters than the HP group.

**Conclusions:** This study demonstrated that verbal fluency for proper nouns may be particularly sensitive to the early cognitive changes in PD. Correspondence: *Eric M. Fine, Ph.D., Veterans Healthcare System San Diego, Psychology Service (116B) - Delis Lab, VA San Diego Healthcare System, 3350 La Jolla Village Drive, San Diego, CA 92161. E-mail: fine.eric@gmail.com*

#### M.C. GREENAWAY, N.L. DUNCAN, A.B. SOLLINGER & G.E. SMITH. The Memory Support System for Mild Cognitive Impairment: Initial Results of a Randomized Control Trial.

**Objective:** This study created a compensatory memory notebook program [Memory Support System (MSS)] to help individuals with amnes-

tic Mild Cognitive Impairment (MCI) manage memory difficulties. The MSS is a calendar/organization system with accompanying curriculum for individuals with progressive memory impairment. This project presents the initial results of a randomized control trial focused on the functional impact of the MSS on individuals with MCI.

**Participants and Methods:** Twenty MCI participants and their care partners were randomized to either a six-week MSS training program or received the MSS without training. The 12 intervention participants did not significantly differ from the 8 controls in terms of age, gender, ethnicity, or overall cognitive function. Compliance and functional ability were assessed at beginning, end, and eight-week post intervention.

**Results:** In the intervention group, 92% were compliant with the MSS by training end compared to 13% of controls. Greater compliance in the intervention group remained significant at follow up,  $t(15) = 3.1, p < .01$ . Intervention participants showed significant improvement in functional ability (Everyday Cognition) compared to controls by training end,  $t(15) = 2.8, p = .01, d = 1.2$ , and at follow up,  $t(13) = 2.2, p < .05, d = 1.1$ .

**Conclusions:** Results suggest individuals with MCI are capable of learning a calendar system that leads to significant improvements in memory related activities of daily living. These findings were maintained at 8 week follow up. Information about the effects of the MSS on quality of life, mood, self efficacy, and partner burden/mood will also be presented. Correspondence: *Melanie C. Greenaway, PhD, Emory University; Wesley Woods Health Center, 1841 Clifton Rd NE, Atlanta, GA 30329. E-mail: mcgree3@emory.edu*

#### R. HART, J. WADE, M. BEAN & D. GIBSON. Intellectual Decline Predicts Global Functional Deficits in Dementia.

**Objective:** To examine the relationship between general intellectual decline and change in a broad range of daily living skills and adaptive functioning.

**Participants and Methods:** General intellectual functioning (WASI Full Scale IQ) and a broad range of performance-based adaptive knowledge and skills (Street Survival Skills Questionnaire; SSSQ) were assessed in 64 elderly individuals referred for clinical evaluation because of suspected dementia. An estimate of premorbid ability was derived from the summed average of a demographic formula (Barona) and a measure of reading skills (American NART) adjusted for MMSE scores using an empirically-derived correction formula.

**Results:** Both estimated premorbid IQ and estimated decline in IQ (i.e., premorbid IQ – WASI FSIQ) correlated moderately with the SSSQ total score. WASI FSIQ was highly correlated with SSSQ total score ( $r=.72$ ). After controlling for age and Beck Depression score, regression analyses showed that both estimated decline in IQ and WASI FSIQ reliably predicted SSSQ total scores and accounted for an additional 30% or 56% of the variance in SSSQ scores, respectively. The amount of decline in IQ correlated significantly with all 9 SSSQ subtest scores ( $p's < .01$ ) representing a wide range of daily living skills. WASI FSIQ had a similar pattern but higher overall correlations with SSSQ subtest scores, except for a disproportionately stronger relationship with the ability to make measurements (e.g., use a ruler) due to the relative importance of premorbid ability for this particular skill.

**Conclusions:** These findings demonstrate that general intellectual ability predicts a broad range of functional deficits. Studies purporting to demonstrate that impairments in particular neuropsychological domains (e.g., executive function) predict specific functional deficits need to control for the effect of general intellectual decline.

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#### A. JEFFERSON, D.F. TATE, A. GENTILE, K. HUBER, F. RUBERG & E.J. BENJAMIN. Systolic function and cognitive aging in mild cognitive impairment: Preliminary results.

**Objective:** Prior research in a small referral-based sample of patients with cardiovascular disease indicates that reduced cardiac output is re-

lated to neuropsychological and neuroanatomic abnormalities in the absence of clinical dementia or stroke. It is not yet known if these relations are associated with maladaptive brain aging in older adults with mild cognitive impairment (MCI). The current pilot study relates systolic function to early cognitive markers of vascular and AD pathology among individuals with MCI.

**Participants and Methods:** 3T cardiac MRI and neuropsychological data were collected on MCI participants free from clinical stroke (62-84 years,  $74 \pm 7$ ; 46% women). Ejection fraction and cardiac output, determined by cardiac MRI, were related to neuropsychological measures sensitive to early markers of vascular (e.g., executive functioning) and AD pathology (e.g., learning and memory).

**Results:** Unadjusted bivariate correlations suggest that cardiac output was significantly associated with CVLT Short Delay Free Recall ( $r=0.74, p=0.014$ ) and Long Delay Free Recall ( $r=0.89, p=0.001$ ). Partial correlations, adjusting for age, body surface area, and systolic blood pressure, did not attenuate the findings, as cardiac output remained significantly associated with CVLT Short Delay ( $p=0.80, p=0.03$ ) and Long Delay Free Recall trials ( $p=0.91, p=0.005$ ). No significant associations emerged for ejection fraction and the neuropsychological variables.

**Conclusions:** Our pilot data suggest that as cardiac output decreases, verbal episodic memory performance also decreases. Additional cross-sectional data collection and longitudinal follow-up of this cohort will help determine if cardiac output is associated with accelerating maladaptive brain aging in MCI. The successful completion of this research will increase understanding about the complex interrelations between subclinical and clinical impairments in myocardial function and cognitive progression prior to the onset of clinical dementia or stroke.

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#### L.P. KELLEY, C.C. PRICE, S.D. TOWLER, S.M. MITCHELL, C. DOW, A.M. PERUMAL, I. SCHMALFUSS & L.J. DAVID. Comparison of Quantification Methods for Lacune Volume.

**Objective:** Lacunae are important markers of vascular disease on brain CT and MRI. Existing literature is vague on the most appropriate measurement approach. This investigation was designed to examine differences in intra-rater and inter-rater reliability for a visual rating method versus a novel manual input computerized segmentation approach to identifying rapid and reliable quantification methods that will facilitate future research examining the incidence and extent of lacunae in dependence of risk factors and cognitive function.

**Participants and Methods:** Of 133 dementia volumetric T-1 weighted brain magnetic resonance imaging scans, 45 were selected to represent a gradation of severity (mild, moderate, severe; 15 for each group). Two trained lacunae raters blind to severity grouping separately measured each brain twice using two methods. The visual rating method used a radiological visualization tool (Efilm) with an on-screen ruler to estimate volume. The manual input computerized segmentation program automatically calculated volume based on input of pixel size and allows one to save spatial and regional information about lacune location (<http://www.itksnap.org>). Only lacunae with a diameter > 2mm were graded.

**Results:** Bivariate correlation revealed highest intra-rater and inter-rater reliability for the visual rating scale ( $r=0.98, r=0.89$ , respectively). The intra-rater reliability on the manual segmentation was high ( $r=0.93$ ), however the inter-rater reliability was low ( $r=0.44$ ).

**Conclusions:** The visual rating method had the highest inter-rater reliability. The computerized manual program demonstrated high intra-rater reliability but inadequate inter-rater reliability. Differences in the quantification methods and problems with computerized segmentation approaches will be discussed.

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**L.E. KIRSCH-DARROW, M. MARSISKE, M. OKUN, K. FOOTE & D. BOWERS. Longitudinal Change in Apathy Following Deep Brain Stimulation for Parkinson's Disease.**

**Objective:** Recent studies report increased apathy in PD patients after DBS. However, no studies to date capture the longitudinal trajectory of change in apathy symptoms after DBS. We used latent growth curve modeling with multiple assessments of apathy to better characterize initial status and rate of change of apathy.

**Participants and Methods:** Forty-two PD patients ( $60 \pm 8.4$  yrs) underwent unilateral DBS and completed: Apathy Scale (AS) and Beck Depression Inventory (BDI) prior to surgery, and bi-monthly until 6 months post-surgery. Latent growth curve modeling (AMOS 16) was used to describe the initial level and rate of change in apathy. Predictors included site of implantation (STN/GPi), age, pre-surgery motor severity and depression score, and percent reduction in levodopa after surgery.

**Results:** An unconditional linear growth model indicated significant means and variances for the apathy intercept and slope. The best fitting model had a slope factor fixed to 0,1,2,2 ( $\chi^2(6) = 5.80, p = .45, NFI = .923, RFI = .871, IFI = 1.0, TLI = 1.0, CFI = 1.0, RMSEA = .000, p = .51, AIC = 21.8$ ). On average, patients started at an Apathy Scale of 10 points and increased bi-monthly by 1.1 points. Interindividual differences on initial apathy score (pre-surgery) was significantly related to pre-surgery depression score. Steeper rate of increase in apathy was related at trend level to STN implantation (vs. GPi), and younger age.

**Conclusions:** Results suggest that apathy increases from pre-surgery to 2 and 4 months post-surgery, and then plateaus between 4 and 6 months. Findings will be discussed in terms of potential mechanisms underlying temporal changes in apathy following DBS.

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**M. LAMAR, T. DANNHAUSER & S.S. SHERGILL. Subjective Memory Complaints with and without Objective Memory Impairment: The Impact of Leukoaraiosis on Cognitive Phenotypes.**

**Objective:** White matter neuropathology, i.e., diffuse leukoaraiosis (LA) on structural MRI, results in cognitive (i.e., executive and visuo-spatial) dysfunction and increases the risk for and expression of dementia. LA also impacts subjective memory complaints in otherwise healthy adults. Little is known about the interplay between LA, memory complaints and cognition. We investigated cognitive phenotypes associated with LA in select populations of older adults.

**Participants and Methods:** Based on cognitive testing and responses regarding perceived memory impairment, individuals with Hachinski scores under 4 were categorized as subjective memory impaired (SMI: subjective but no objective memory impairment;  $n=11$ ) or mild cognitively impaired (MCI: objective and subjective memory impairment;  $n=20$ ). A visual rating scale categorized MRI LA in five regions per hemisphere: frontal and parietal centrum semiovale, frontal and posterior horns and body of the lateral ventricles. MRI data was correlated with cognitive test data within each group controlling for age, overall cognitive status and complaint duration.

**Results:** LA was present in equal measure across groups; however, significant associations to cognition were present in the SMI group only. As LA severity increased, CAMCOG errors of language expression ( $r=.68, p=0.03$ ), abstract reasoning ( $r=.81, p=0.008$ ) and recent memory ( $r=.64, p=0.04$ ) increased and increasing LA correlated with decreasing Logical Memory learning slopes ( $r=-.88, p=0.004$ ).

**Conclusions:** The cognitive phenotype of SMI with increasing LA suggested an AD-type profile involving language, learning and memory and occurred in the presence of relatively low Hachinski scores. In the absence of objective memory impairment, the specific associations between cognition and LA in SMI may provide an early indicator of pathological aging.

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**E.M. LANE, R.H. PAUL, R.A. COHEN & D.J. MOSER. Influence of Education on Subcortical Hyperintensities and Cognitive Outcome in Vascular Dementia.**

**Objective:** In Vascular Dementia (VaD) populations, subcortical hyperintensities (SH), areas of subcortical ischaemic stroke visualized on neuroimaging, are a hallmark feature of the disease and correlate with cognitive decline. Research suggests that greater educational attainment, a proxy measure of cognitive reserve, may allow an individual to withstand greater amounts of damage before exhibiting a functional decline in cognitive status. We predicted that performance on the Mini Mental State Exam (MMSE), a test of global cognitive status, would decline more over a one year period of time for subjects with higher amounts of change in SH volume than for those with lower amounts of change in SH volume. Additionally, individuals with higher educational attainment would show less cognitive decline, even with comparatively equal or greater SH volume.

**Participants and Methods:** All subjects, aged 55 and older (mean age = 77.56, mean education = 12), were diagnosed with probable VaD using the NINDS/AIREN and DSM-IV criteria. At baseline analysis, 39 subjects underwent MMSE evaluations and MRI. MMSE evaluations were again performed at 6 months. At a 12 month follow-up consisting of 26 subjects, MMSE and MRI were once again obtained.

**Results:** Path analysis revealed that individuals with greater SH change over time had a significantly higher decline on MMSE scores than those with less volume change. Additionally, education moderated the relationship between SH volume and MMSE score.

**Conclusions:** While greater amounts of SH volume contribute to cognitive decline in VaD patients, educational attainment can buffer these damaging effects, providing a cognitive reserve and offsetting the effects of dementia.

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**C. WEINSTEIN, B.K. LEBOWITZ, A. BEISER, S. SESHADRI, P.A. WOLF & R. AU. Impact of Reading Impairment on MCI Progression.**

**Objective:** Not all individuals meeting criteria for mild cognitive impairment (MCI) progress to Alzheimer's disease (AD.) This study investigated how progression of amnesic MCI is affected by prevalent reading impairment.

**Participants and Methods:** The community-based, stroke and dementia-free Offspring cohort of the Framingham Heart Study, who had undergone baseline (1999-2005) and repeat (2005-2006; > 1 yr from baseline) neuropsychological evaluations that included the WMS Logical memory, immediate (LM-IR) and delayed recall (LM-DR) tests, were divided into two groups: those with amnesic MCI (MCI-A;  $n=67$ ) and those with no deficits in any cognitive domain (Control;  $n=1045$ ). The MCI-A group was defined by performance of > 1.5 s.d. below age, education adjusted means on a computed verbal memory factor plus no executive dysfunction and was further divided into those with a self-reported history of learning difficulties and WRAT-Reading score > .5 s.d. below age and educated adjusted mean (MCI-RI;  $n=6$ ) vs those without a self-reported history of learning disability and impaired WRAT-Reading score (MCI-NoRI;  $n=61$ ).

**Results:** After adjusting for age, education and sex, the MCI-RI group showed significantly less decline in LM-IR compared to the MCI-NoRI group (mean decline of -0.145 vs. 0.511, respectively;  $p=0.017$ .) Similarly, on LM-DR, the MCI-RI group showed significantly less change in performance compared to the MCI-NoRI group (mean decline of 0.109 vs. 0.583, respectively;  $p=0.047$ .)

**Conclusions:** In a subset of MCI cases, deficit performance may reflect longstanding learning difficulties and not preclinical AD. Results must be interpreted in light of the cognitive reserve hypothesis as well as an individual's unique neurodevelopmental history.

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**B.K. LEBOWITZ, C. WEINSTEIN, A. BEISER, S. SESHADRI, P.A. WOLF & R. AU. Relationship of Suspected Reading Disorder to Prevalent MCI.**

**Objective:** While a relatively high percent of amnesic mild cognitive impairment (MCI-A) cases progress to AD, a significant number of cases also demonstrate a stable, lower level of cognitive functioning across time. We examined whether there is a higher prevalence of suspected reading disorder among those with MCI-A.

**Participants and Methods:** Subjects were comprised of the community-based Framingham Heart Study Offspring cohort who were screened for prevalent dementia and stroke and who had been administered a neuropsychological test battery from 1999-2005. All participants were given the WMS Logical Memory Immediate (LM-IR) and Delayed (LM-DR) recall tests and the WRAT III-Reading subtest. The study sample was further divided into two study groups: those with amnesic MCI (MCI-A, performance > 1.5 s.d. below age, education-adjusted means on a computed verbal memory factor and no deficits in executive function; n=133) and those without significant impairment in any cognitive domain (No MCI, n=1,842).

**Results:** Higher WRAT-Reading scores were associated with lower prevalence of MCI-A (OR=0.69, 95%CI 0.56-0.84,  $p<0.001$ ). Reading impairment, defined as > 0.5 s.d. below age, education and sex adjusted mean, was linked to higher prevalence of MCI-A (OR=1.48, 95%CI 1.02-2.16,  $p=0.038$ ). There was no effect modification by age, sex, or education.

**Conclusions:** Individuals with longstanding reading/learning disorders may be incorrectly diagnosed as having MCI, suggesting a neurodevelopmental history is needed in an MCI evaluation. Alternatively a high WRAT-III score may reflect greater cognitive reserve protecting an individual from the development of MCI-A and clinical dementia.

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**L. LOPEZ, K.J. MILLER, J. KIM, S. PANOS & G.W. SMALL. Semantic and Phonemic Fluency in Age Consistent Memory Impairment and Mild Cognitive Impairment.**

**Objective:** Verbal fluency tasks are an essential component when diagnosing cognitive impairment. Prior research has suggested that both semantic and phonemic fluency tasks have shown sensitivity when used for diagnosis of and Alzheimer's disease. The goal of the current study is to examine whether semantic or phonemic fluency tasks are sensitive enough to detect subtle declines in cognitive functioning found in mild cognitive impairment (MCI) compared to normal aging (age-consistent memory impairment, ACMI).

**Participants and Methods:** Our study consisted of 134 participants (93 controls, 41 MCI-amnesic type), including 78 women, with the mean age of 63.41 (SD = 12.19). All participants completed a full neuropsychological evaluation, including standard memory testing, which was used for diagnosis of ACMI and MCI.

**Results:** After controlling for education and gender, ANCOVA revealed that those with MCI exhibited significantly lower scores than the controls for both semantic fluency and phonemic fluency. The control group named 21-22 animals (M = 21.91, SD = 4.99) and 45 words in FAS (M = 45.45, SD = 13.50). The MCI group named 16 animals (M = 16.10, SD = 5.00) and 37-38 words in FAS (M = 37.52, SD = 10.97).

**Conclusions:** These results suggest that both semantic and phonemic fluency tasks are sensitive to the cognitive changes found in MCI. This study contributes to an already growing body of research that supports the use semantic fluency as a screening tool to assess for the need for further neuropsychological evaluation (Cunje, et al., 2006; Miller, et al., 2007).

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**L. LOPEZ, K.J. MILLER, J. KIM, S. PANOS, J. BEDICS & G.W. SMALL. Semantic and Phonemic Fluency as a Brief Cognitive Screening Tool.**

**Objective:** Clinicians are often in need for more efficient and effective screening tools to use with patients presenting with memory complaints. Recent research studies (Cunje et al. 2006, Miller et al. 2007) have demonstrated the efficacy of using a semantic fluency task in differentiating between controls and MCI. The goal of this study was to examine whether a 1 minute verbal fluency screening tool (Animals) would be as effective as a four minute screening tool (FAS and Animals) in predicting MCI from normal aging (ACMI).

**Participants and Methods:** Our study consisted of 134 participants (93 controls, 41 MCI-amnesic type), including 78 women, with the mean age of 63.41 (SD = 12.19). All participants completed a full neuropsychological evaluation, including standard memory testing, which was used for diagnosis of ACMI and MCI.

**Results:** Logistical regression was used to examine whether FAS or Animals would be a better predictor of MCI. Analyses revealed that FAS accounted for only 7.6% of the variance in the model, while Animals accounted for 22.7% of the variance. A test of the full model revealed that FAS and Animals together account for 23.1% of the variance, showing only .4% gain from Animals alone.

**Conclusions:** These results suggest that semantic fluency alone may be a sensitive enough screening tool to detect the cognitive changes found in MCI from normal aging. This study contributes to an already growing body of research that supports the use semantic fluency as a screening tool to assess for the need for further neuropsychological evaluation (Cunje, et al., 2006; Miller, et al., 2007).

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**J. MARCEAUX, K. TRIEBEL & D. MARSON. Cognitive profiles and early risk factors for Alzheimer's disease.**

**Objective:** Vascular disease and genetic factors are associated with cognitive patterns in Alzheimer's disease (AD). It is unknown if these factors are associated with distinct cognitive deficits in mild cognitive impairment (MCI). This study investigated differences in cognitive profiles of MCI patients having specific risk factors.

**Participants and Methods:** Participants were community-dwelling older adults with an ADRC consensus diagnosis of MCI (IWG criteria, 2004). Participants, matched on age, education, and gender, were grouped into one of three mutually exclusive groups: vascular disease only (VD) (n=12), genetic risk factors only (GE) (n=12), or VD and GE (VD+GE) (n=12). Vascular factors included hypertension, hypercholesterolemia, and diabetes among others, established by self-reported history, specific medication use, blood pressure, or other methods (e.g., BMI calculations). Genetic risk factors included positive APOE-E4 allele and/or positive family history of AD. Those having both types of risk factors were placed into the VD+GE group. Participants completed the same neuropsychological battery. Profile analysis was used to evaluate specific patterns of cognitive performance associated with risk factor groups.

**Results:** Cognitive performance varied across groups ( $p<.01$ ). Findings suggest VD group had lower scores in Animal Naming and Trails B, GE had lower scores on CLOX1, and both suffered in learning and attention. Surprisingly, VD+GE group performed better on most cognitive measures, excepting Trails B.

**Conclusions:** Findings suggest distinct patterns of performance among MCI patients having discrete risk factors for AD. Findings signify the cognitive presentation among those having specific risk factors. Knowledge of these differences may assist clinicians in tracking progression in MCI.

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**N.C. MCLAUGHLIN, A. CHANG & P. MALLOY. Verbal and Non-Verbal Learning and Recall in Dementia with Lewy Bodies and Alzheimer's Disease.**

**Objective:** The aim of the present study was to examine retrospective data from an outpatient memory clinic and inpatient geriatric unit in order to analyze the similarities and differences between Dementia with Lewy Bodies (DLB) and Dementia of the Alzheimer's Type (DAT) groups on verbal and non-verbal memory tasks.

**Participants and Methods:** 54 participants were selected for the study, 22 participants diagnosed with DLB, and 32 participants diagnosed with DAT. DAT and DLB groups were compared on the Hopkins Verbal Learning Test (HVLT) and the Brief Visuospatial Memory Test (BVMPT).

**Results:** The DAT group performed significantly worse than the DLB group on the learning, delayed free recall, and percent retained scores of the HVLT-R. The DAT group also performed worse on the delayed free recall and percent retained scores of the BVMPT-R. There were no significant differences on the BVMPT-R learning score, with the DLB group performing just as poorly as the DAT group.

**Conclusions:** This supports previous research indicating that individuals with DLB have impairments in visuospatial abilities that extend into the domain of memory. Pattern of performance may be useful in discriminating between individuals with DLB and those with DAT.

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**D. MEYERSON, S. KRAUSS-WHITBOURNE & R. READY. Utility of a Processing Speed Measure in Assessing for MCI.**

**Objective:** Mild Cognitive Impairment (MCI) is suspected of being a preclinical phase of Alzheimer's Disease (AD) and is considered to be on a continuum between normal aging and AD. Diagnosis of MCI can often be challenging in the early stages of the disease due to the subtle nature of onset and symptoms, as well as insensitivity of currently available diagnostic instruments (Morris & Cummings, 2005). Recent studies have suggested that declines in cognitive functioning may be present earlier than can be evident on memory testing due to changes in decision speed and executive functioning (Craik, 2008). Furthermore, processing speed may be a better and more sensitive indicator of early cognitive decline (Lopez et al., 2005). Since performance on processing speed tasks tends to decline as part of normal aging (Salthouse, 1994), it makes sense to examine processing speed performance in MCI.

**Participants and Methods:** The current study seeks to examine the differences in processing speed performance between individuals with MCI (N = 37) and an age and education matched control sample (N = 37). In addition the study was also designed to assess the utility of a processing speed measure to differentiate individuals with MCI from a normally functioning group of age-matched adults with no otherwise demonstrable cognitive impairments.

**Results:** The results indicated significant differences in processing speed performance between the MCI and the control sample. The results also indicated that the processing speed measure used in this study can be sensitive to impairments in processing speed in individuals with MCI.

**Conclusions:** Results indicate that processing speed may be a useful screening tool in assessing MCI. Furthermore, the results also point to the need for sensitive screening measures to assess MCI.

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**A.E. MIKOS, M.S. OKUN, L. ZAHODNE, H.H. FERNANDEZ, K. FOOTE, C. JACOBSON & D. BOWERS. Declines in Word Recall and Processing Speed Following Unilateral DBS for Parkinson's Disease: A Controlled Study Using Reliable Change.**

**Objective:** Although Deep Brain Stimulation (DBS) surgery is an effective treatment for medication-refractory Parkinson disease (PD), it may lead to certain cognitive declines. The present study investigated the effects of unilateral DBS on memory, processing speed, executive functioning and visuospatial abilities. Additionally, we examined the clinical significance of effects using reliable change indices and predictors of decline using regression analyses.

**Participants and Methods:** We used the University of Florida Movement Disorders Center research database to compile data from 24 unilateral DBS patients and 19 PD controls of similar age, education and disability level. Neuropsychological testing took place before DBS and 16 months after surgery.

**Results:** Compared to PD controls, the DBS group declined on a processing speed composite but not on the other neuropsychological tests. Reliable change analyses revealed that 25% of DBS patients experienced reliable declines on list learning compared to 0% of controls. Additionally, a small but significant proportion of DBS patients declined relative to controls on tests of story memory, processing speed, and response inhibition. Presurgical performance on the list learning task was a significant predictor of decline on that task, but no other predictors (i.e., age, side of surgery, depression) were significant. Additionally, DBS patients who demonstrated reliable individual decline on the HVLT-R had lower presurgical scores on a cognitive screening measure (DRS-2) than did the subgroup that did not decline.

**Conclusions:** This study suggests that despite minimal group-level changes following unilateral DBS surgery, a small but significant proportion of DBS patients show reliable individual-level declines on memory, processing speed, and response inhibition tasks. Potential mechanisms that underlie these cognitive declines in specific subgroups will be discussed.

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**A.E. MIKOS, M.S. OKUN, L. KIRSCH-DARROW, L. ZAHODNE, K. FOOTE & D. BOWERS. Characterizing Verbal Fluency Declines Associated with Unilateral DBS for Parkinson's Disease.**

**Objective:** Declines in verbal fluency have been commonly reported following deep brain stimulation surgery (DBS) for treatment of Parkinson's disease (PD), but it is not clear whether these declines are due to the surgical procedure or to stimulation. Examination of the clustering and switching component processes of the task may help to clarify the nature of the deficit. The purpose of the present study was: (1) to examine whether the decline in verbal fluency can be attributed primarily to effects of surgery or of stimulation and (2) to investigate performance on subcomponent processes of the task.

**Participants and Methods:** 21 PD patients performed verbal fluency tasks before and 16 months after unilateral DBS surgery. Following surgery, a partially overlapping group of 37 unilateral DBS patients performed letter fluency tasks both "on" and "off" stimulation. Verbal fluency protocols were analyzed for total number of correct words produced as well as clustering and switching performance. Paired samples t-tests were used to compare dependant variables.

**Results:** Aim 1: DBS patients had significantly lower letter and animal fluency scores following surgery compared to before surgery. There were no differences in letter fluency scores "on" compared to "off" stimulation. Aim 2: DBS patients made significantly fewer switches for both fluency tasks after surgery compared to before, but there were no differences in cluster size. There were no differences in clustering and switching performance "on" stimulation compared to "off" stimulation.

**Conclusions:** These findings suggest that the decline in verbal fluency performance can be attributed more to an effect of DBS surgery than to stimulation. This decline is characterized by decreased switching ability.

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**S.M. MITCHELL, C.C. PRICE, J.J. TANNER, S.D. TOWLER, D.M. MAHFOOD, D.J. LIBON & K.M. HEILMAN. The Relationships Between Regional Leukoaraiosis, Brain Structure, and Cognition in Dementia.**

**Objective:** The regional contribution of Leukoaraiosis (LA) to cognitive impairment in dementia is not well understood. The purpose of this study was to examine the relationship of regional LA with other brain variables on cognition in dementia.

**Participants and Methods:** Sixty individuals with mild to moderate dementia (MMSE=22.6±3.3; age=80.1±5.4; education=12.1±2.8) were studied with brain MRI and neuropsychological testing. LA was quantified using a semiautomated thresholding technique and was divided into three regions: infracortical, periventricular, and deep. Volumetric measurements were also obtained for the head of the caudate, lateral ventricles, and whole brain. Standardized composite indices of executive function, language and memory were used as dependent variables.

**Results:** Hierarchical regression analyses indicated that: 1) caudate volume alone was not a significant predictor of executive functioning; the model was significant only with the addition of deep LA ( $R^2=.15$ ,  $F=3.16$ ,  $p=.03$ ; bivariate correlation between deep LA and caudate,  $r=-.31$ ,  $p=.01$ ); and 2) periventricular LA was a significant predictor of ventricular volume ( $R^2=.43$ ,  $F=21.37$ ,  $p<.001$ ) but predicted neither executive functioning nor language/memory performance. There was, however, a significant relationship between whole brain volume and language/memory ( $r=.26$ ,  $p=.05$ ).

**Conclusions:** There is anatomical and functional significance to examining regional LA on cognition in dementia. While increasing periventricular LA associates only with widening of the lateral ventricles and has no cognitive association, increasing deep LA associates with shrinking of the caudate and executive function decline. The interaction of infracortical LA and cortical atrophy on memory/language needs further investigation.

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**A. NEWMAN, R. WISNER-CARLSON, P. NOTARANGELO & V. KO-LIATSOS. Use of MMSE & SLUMS in Screening for Dementia: Two Case Studies.**

**Objective:** The MMSE (Mini Mental Status Examination) is a well known screening instrument for detecting moderate to severe dementia but is less effective in identifying individuals with Mild Cognitive Impairment (MCI). The SLUMS (Saint Louis University Mental Status) was more recently developed to improve screening techniques for identifying MCI by increasing the complexity of the items but is not well known or researched.

**Participants and Methods:** Two cases are described in which both instruments were used and a significant difference in scores was obtained such that the MMSE scores were in the unimpaired range and the SLUMS scores indicated dementia. Case 1 is a 78 year old male with a history of stroke who was referred for a comprehensive neuropsychological evaluation after obtaining an MMSE score of 29/30 and a SLUMS score of 19/30. Case 2 is a 75 year old male with a history of traumatic brain injury who was referred for a comprehensive neuropsychological evaluation to assess the possibility of an additional neurodegenerative disorder. He obtained an MMSE score of 28/30 and a SLUMS score of 16/30. The work was funded in part by the Stulman Foundation.

**Results:** In Case 1, neuropsychological assessment revealed isolated severe executive deficits without memory or language impairments. In Case 2, neuropsychological assessment revealed severe shortterm memory loss and impairments in aspects of executive functioning.

**Conclusions:** These cases support studies demonstrating that high scores on the MMSE may mask an underlying neurocognitive disorder and indicate that the SLUMS may be more sensitive to cognitive impairments whatever their etiology or severity.

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**E. PIROGOVSKY, C.K. TONER, C. JENKINS, G.M. PEAVY, D.P. SALMON, D.R. GALASKO & P.E. GILBERT. Temporal Sequence Learning in Amnesic Mild Cognitive Impairment.**

**Objective:** Research suggests that the hippocampus is involved in temporal sequence learning. Patients with amnesic mild cognitive impairment (MCI) show neuropathological changes in the hippocampus, suggesting that temporal sequence learning may be impaired in MCI.

**Participants and Methods:** Patients diagnosed with MCI ( $n=6$ ) and age-and-gender matched healthy older adults ( $n=6$ ) were administered a visuospatial temporal sequence task on a computerized radial 8-arm maze. On each trial, a circle appeared individually at the end of each of the eight arms. The participant was asked to reproduce the temporal sequence by placing numbered circles (1-8) on the arms of a printed copy of the 8-arm maze. The participant was presented the same sequence repeatedly until the sequence was replicated without any errors or until 15 trials were presented.

**Results:** MCI patients required significantly more trials to complete the temporal sequence ( $M=9.8$ ,  $SE=1.8$ ) and committed more errors ( $M=44.2$ ,  $SE=12.5$ ) relative to healthy older adults (trials:  $M=2.2$ ,  $SE=.65$ ,  $p<.01$ ; errors:  $M=3.3$ ,  $SE=2.0$ ,  $p<.01$ ). Two MCI patients did not learn the sequence within 15 trials.

**Conclusions:** These results suggest that temporal sequence learning may be sensitive to neuropathological changes associated with MCI. The temporal organization of sequenced events is critical for the accurate formation and retrieval of episodic memories, suggesting that temporal sequencing impairments may contribute to episodic memory deficits in MCI.

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**L. RITCHIE & H.A. TUOKKO. Development of a Clinical Decision Tree for Identifying Conversion to Dementia in Older Adults.**

**Objective:** The absence of gold standard diagnostic criteria for mild cognitive impairment (MCI) has resulted in variable nomenclature, case definitions, outcomes, risk factors, and prognostic utilities. Our objective was to identify the risk factors and clinical correlates of cognitive impairment, no dementia (CIND) that differentiate persons who convert to dementia, from those who do not, in a population-based sample of elderly Canadians.

**Participants and Methods:** We undertook an exploratory statistical analysis through the unique application of a machine learning algorithm to elucidate the clinical correlates of conversion using data from participants who underwent a clinical evaluation in the second wave of the Canadian Study of Health and Aging ( $N=289$ ). The Quick, Unbiased, and Efficient Statistical Tree (QUEST) recursively partitioned selected variables to form a hierarchical binary decision tree.

**Results:** 60% of CIND participants converted to dementia after five years. Baseline total immediate recall using a selective reminding test (SRT) was the sole predictor of conversion. While the cognitive and overall classification trees were associated with high sensitivities, sub-optimal specificities and predictive values were noted.

**Conclusions:** In the presence of other risk factors, poor episodic memory (specifically retrieval) supersedes all other predictors in the early identification of persons at risk of dementia over five years. Given the limited predictive values, we recommend employing significant predictors as markers for ongoing monitoring and assessment, rather than as clinical markers of conversion. Overall, a single set of diagnostic criteria may not capture the architecture of pathological cognitive decline to dementia.



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**A. RUEDA, C. PARSEY & M. SCHMITTER-EDGECOMBE. Clock Drawing in Healthy Aging and Mild Cognitive Impairment.**

**Objective:** This study explored the effects of early stage dementia on clock drawing ability using qualitative (modified Rouleau 1992) and quantitative (Royal, 1998) scoring.

**Participants and Methods:** Participants were 26 older adult controls (OA), 26 individuals with amnesic mild cognitive impairment (a-MCI), and 14 individuals with non-amnesic MCI (n-MCI). The Rouleau qualitative error analysis examined the following domains: graphic difficulties, stimulus-bound responding, conceptual deficits, spatial and/or planning deficits, and perseveration. Scores for each domain were obtained along with frequency totals for individual errors within each domain. A total clock drawing score was derived using the Royal Clox method.

**Results:** For the total clock drawing score, the a-MCI group performed more poorly than the OA controls. Qualitative scoring revealed no significant domain differences between the OA and MCI groups. The analysis did, however, reveal that the n-MCI group demonstrated more errors in spatial/planning categories compared to the a-MCI group: systematic deficit in planning of numbers (35.7% vs 19.2%), random deficit in spatial layout of numbers (57.1% vs 38.5%), and numbers written outside clock face or on outer circle (21.4% vs 11.5%). While, on the other hand, the a-MCI group demonstrated more conceptual errors compared to the n-MCI group: misrepresentation of the clock (23.1% vs 7.1%), misrepresentation of the time (42.3% vs 28.6%), errors in numbering (26.9% vs 14.3%).

**Conclusions:** The qualitative scoring system for the clock drawing may aid in highlighting the different underlying processes associated with amnesic versus non-amnesic MCI and may be useful in helping to identify subtle differences characterizing these groups.

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**K.A. RYAN, A. WELDON, L. FRANTI, N. STAFFEND, A.K. BHAUMIK, C. PERSAD & B. GIORDANI. MCI, but not AD, Patients' Neurobehavioral Symptoms are Related to Formal Service Needs Among Caregivers.**

**Objective:** Caregiver burden and support concerns are common among caregivers of patients with Alzheimer's disease (AD), but infrequently considered when patients experience less severe cognitive impairment (e.g., Mild Cognitive Impairment, MCI). We have previously shown that caregivers of patients with MCI are experiencing a similar need for social support services as do those AD caregivers. This study examines whether patients' health and behavioral status contribute to this need.

**Participants and Methods:** Participants were 80 Patient/Caregiver pairs (25 MCI; 55 AD) seen through the University of Michigan Alzheimer's Disease Research Center. Caregivers completed questionnaires about the patient's functional abilities, neuropsychiatric symptoms, bodily strength/health, and social service need. Patients were administered a battery of neuropsychological tests.

**Results:** In the MCI group, poorer neuropsychiatric functioning and lower bodily strength/health were related to increased social service needs ( $r_s = .43, .42; p = .04, .04$ ). In AD caregivers, however, neuropsychiatric symptoms were not related to service need ( $r = .19, p = 1.78$ ), though decreased strength and functional status were ( $r_s = .40, .47, p = .00, .00$ ). Overall cognitive status did not relate to need in either patient group.

**Conclusions:** Although strength and health issues were related to social service need among all caregivers in this study, patients' neuropsychiatric symptoms were important contributors only in the MCI group. Early identification of MCI patients with frailty or psychiatric issues may be particularly important for predicting caregiver burden. Among the AD caregivers, patients' health and related functional status may be most important to consider in terms of social service need.

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**D.M. SCHIEHSER, L. DELANO-WOOD, A.J. JAK, K.J. BANGEN & M.W. BONDI. Neuropsychological Profile of and Longitudinal Change in Amnesic and Nonamnesic Mild Cognitive Impairment.**

**Objective:** Mild cognitive impairment (MCI) has been recently classified into amnesic and nonamnesic subtypes by the presence or absence of a memory deficit. However, the profile of and changes in neurocognitive abilities and complex activities of daily living (ADL) have not been well-characterized in these dichotomized groups. The purpose of this study was to examine cross-sectional and longitudinal changes on an expanded neuropsychological battery and a measure of independent living skills in nonamnesic and amnesic MCI.

**Participants and Methods:** Twenty-four nonamnesic and 23 amnesic demographically-matched MCI patients were administered a standardized neuropsychological battery and the Independent Living Scales (ILS) as a measure of complex ADL. A subset of the original MCI patient sample was reassessed a mean of 1.5 years after their initial evaluation.

**Results:** Relative to nonamnesic MCI patients, amnesic MCI patients demonstrated a trend toward a poorer performance on the Managing Money scale of the ILS and a worse performance on an independent measure of memory not used in diagnosis assignment. Nonamnesic MCI patients performed poorer on a measure of executive function compared to amnesic MCI; however, no other neuropsychological index dissociated these groups. Both groups remained cognitively stable over time.

**Conclusions:** The findings of this study support the classification of amnesic MCI and nonamnesic MCI subtypes based on performances on measures of memory, executive function, and ADL, but do not support a dissociation of these subgroups based on other neurocognitive abilities. Both groups demonstrated minimal cognitive changes over an 18-month follow-up period, suggesting that cognition for both non-amnesic and amnesic MCI may be relatively stable over the short-term. Correspondence: *Dawn M. Schiehser, Ph.D., Psychiatry, UCSD, Mailbox 116-B, VA San Diego, 3350 La Jolla Village Drive, La Jolla, CA 92161. E-mail: dschiehser@ucsd.edu*

**S. SISCO, S. COOK & M. MARSISKE. Differences in Healthy and Mild Memory Impaired Adults' Memory for Stories: The Effect of an Everyday Distraction.**

**Objective:** To test whether there are qualitative differences between healthy and impaired adults' memory for stories during the simultaneous performance of a low- or high-speed simulated driving task.

**Participants and Methods:** A sample of 41 healthy older adults (61% women; mean age = 76.39 years, mean education = 15.83 years) and 12 mildly memory impaired older adults (67% women; mean age = 79.5 years, mean education = 16 years) were asked to recall brief short stories that were administered under three conditions: no driving, low-speed (30 mph) driving, high-speed (60 mph) driving. Stories were scored on four dimensions: 1) percentage recalled verbatim 2) percentage recalled in paraphrase, 3) percentage of main ideas recalled, and 4) percentage of details recalled. Group differences on each of the four dimensions of recall were analyzed in separate repeated measures ANOVAs.

**Results:** Healthy adults recalled more than the impaired in every type of recall except for paraphrase ( $F(1, 51)=11.7-17.32, p=.001$ ). Verbatim, main idea, and detail recall also declined significantly for both groups with increasing condition difficulty ( $F(2, 102)=3.01-16.29, p=.001-.05$ ). However, no impairment-by-condition interaction was obtained for any dimension of recall, nor was such an interaction obtained for overall recall.

**Conclusions:** The first two findings suggest that 1) mildly impaired adults generally recall less than the healthy, and 2) distraction negatively affects most dimensions of recall. However the absence of an impairment-difficulty interaction suggests that, when additional demands are made of their attention, seniors with mild memory impairment may not be at any greater risk of forgetting than their healthy peers.

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**B.E. SNITZ, L.A. MORROW, E.G. RODRIGUEZ, L. CIMINO, K.A. HUBER, C.L. STERLING, K. METHENY, S. GICONI & J.A. SXTON. Availability of Neuropsychological Test Results Increases Likelihood Primary Care Providers Will Address Dementia Issues.**

**Objective:** The study examined the impact on primary care physician practices of systematic, comprehensive neuropsychological evaluation focused on detection of dementia and mild cognitive impairment (MCI).

**Participants and Methods:** Reports with specific recommendations were provided to 12 PCPs regarding cognitive status of 131 outpatients age 65 and older. This 'Intervention' group was compared to a 'Treatment-As-Usual' group in which 93 outpatients were evaluated but no report was provided to their PCPs (n = 10). PCP practices were randomly assigned to the treatment arms. Outcome assessment included detailed medical chart review over two years (mean follow-up 17.2 months) examining documentation of PCP actions related to assessment and management of MCI/dementia.

**Results:** Despite randomization, results showed a slightly higher proportion of impaired patients (MCI/dementia) in TAU (49.4%) vs. Intervention (37.4%) groups (p=.07). Nevertheless, Intervention PCPs ordered more blood tests for dementia (n = 6 patients, 4.7% vs. 0); prescribed more anti-dementia medications (n=6, 4.8% vs. 0); and provided more non-drug intervention for dementia (n=24, 19.2% vs. 0) than TAU. Among MCI patients in the Intervention group (n=43), 30% had chart documentation of memory loss, compared to 19% (of n = 43) in the TAU group. Of note, although rates of documentation of cognitive issues were low overall, only PCPs in the Intervention group were observed to prescribe anti-dementia medications, order laboratory screening tests and provide non-drug intervention (e.g., dementia education, service recommendations).

**Conclusions:** Findings suggest a modest but detectable impact of systematic neuropsychological evaluation in a PCP setting.

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**A.B. SOLLINGER, F.C. GOLDSTEIN, J.J. LAH, A.I. LEVEY & S.A. FACTOR. Neuropsychiatric Symptoms in Parkinson's Disease with Mild Cognitive Impairment.**

**Objective:** A range of neuropsychiatric features have been documented in Parkinson's disease (PD), with higher rates found in PD with dementia (PDD). We determined the frequency and severity of neuropsychiatric features in PD and associated mild cognitive impairment (PD-MCI) versus cognitively intact (PD-CI) and PDD patients.

**Participants and Methods:** We performed a chart review of sixty-four PD patients evaluated in Emory University's Memory and Movement Disorders Clinics who had undergone a comprehensive evaluation, including review of history, informant interview, functional assessment, and neurological and neuropsychological examinations. We used the Neuropsychiatric Inventory to assess the presence and severity of psychiatric disturbances.

**Results:** We classified 30 individuals as PD-CI, 24 as PD-MCI (per Petersen criteria), and 10 as PDD (per DSM-IV-TR criteria). The most frequent psychiatric symptoms in PD-MCI were depression, apathy, anxiety, and hallucinations. Elation, disinhibition, and delusions were least prevalent. When compared to PD-CI, hallucinations and anxiety were

more frequent in PD-MCI, while hallucinations, anxiety, and agitation were more frequent in PDD versus PD-CI. There were no differences in frequency of symptoms between PD-MCI and PDD. To investigate severity, we compared only patients with the symptom of interest present and no differences emerged. Psychotropic medication use was similar among the groups.

**Conclusions:** These findings are consistent with studies reporting frequent neuropsychiatric symptoms in PDD and extend the results to PD patients with mild cognitive impairment. PD-MCI patients exhibited a profile and frequency of neuropsychiatric symptoms that was more typical of that seen in PDD versus PD-CI. These symptoms may represent risk factors for development of dementia.

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**A.C. SOLOMON, J.C. STOUT, N.E. CARLOZZI, S. QUELLER, K. WHITLOCK, E.H. AYLWARD, P. NOPOULOS, D.R. LANGBEHN, B. SPARKS & J.S. PAULSEN. Neuroanatomical Correlates of Episodic Memory in Huntington's Disease.**

**Objective:** Strategic aspects of episodic memory (EM) are impaired in individuals who have the CAG-expansion for Huntington's disease but have not reached the point of clinical diagnosis (pre-HD). This phenomenon has been attributed to early neuropathological changes in the striatum; however, the hippocampus and prefrontal cortex (PFC), two regions known to play vital roles in EM, have also been implicated in HD. This project examined the relationship between regional brain volumes and EM performance in pre-HD.

**Participants and Methods:** The Hopkins Verbal Learning Test-Revised (HVLT-R; Brandt & Benedict, 2001) was administered to 72 individuals with the HD CAG-expansion and 25 individuals who were at-risk for HD but tested negative for the CAG-expansion. Volumetric MRI measures of the striatum, hippocampus, and PFC were obtained via manual tracing and automated parcellation techniques. Analyses controlling for intracranial volume, age, gender, and intellectual function were used to assess group differences in regional brain volumes and EM performance, and to examine brain-behavior relationships.

**Results:** Striatal volumes were smaller in the pre-HD group, whereas hippocampal and PFC volumes did not differ between groups. EM performance was poorer in the pre-HD group, and lower HVLT-R scores were associated with smaller striatal and larger hippocampal volumes. In controls, PFC and striatal volumes were associated with measures of strategy use during encoding and retrieval.

**Conclusions:** Results implicate the striatum in EM dysfunction in pre-HD, and raise some interesting questions regarding the hippocampus in pre-HD. Findings in controls suggest that the dorsolateral prefrontal circuit may be an important component of the neural substrate for strategic memory.

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**M. SPENCER, J. GRACE & J.H. FRIEDMAN. Disentangling Frontal Behavioral Syndromes in Parkinson's Disease.**

**Objective:** Frontal behavioral syndromes (apathy, disinhibition, executive dysfunction) have been attributed to different neuroanatomical circuits (mesial frontal-MF, orbital frontal-OF and dorsolateral prefrontal cortex-DLPFC). We explored the separation versus overlap of these three syndromes in individuals with Parkinson's disease (PD), a patient group with known compromise of frontal subcortical circuits. We hypothesized there would be convergence of measures within each syndrome and a divergence between syndromes. Specifically, we hypothesized disinhibition syndrome would be demonstrable by a convergence of measures of OF function (olfaction, impulsivity). Apathy syndrome was measured to assess MF integrity. DLPFC compromise would be evident on neuropsychological tests of executive functioning.

**Participants and Methods:** Twenty nine PD patients and their family informants completed a smell test (UPSIT), Barrett Impulsivity Scale (BIS), Frontal Systems Behavior Scale (FrSBe), Marin Apathy Evaluation Scale (AES), Geriatric Depression Scale (GDS), Zarit Burden Inventory (ZBI), MMSE, Trails A & B, Controlled Oral Word Association (COWA), Category Fluency (CF).

**Results:** For OF, impaired smell negatively correlated with greater impulsivity ( $r = -.82, p < .000$ ). For MF, apathy measures were highly correlated (FrSBe Apathy and AES ( $r = .60, p < .000$ )) but were not correlated with depression. Apathy related to caregiver burden ( $r = .45, p < .01$ ). Self reported executive problems (FrSBe-E) correlated with COWA and CF but not with Trails. No significant correlations were found between syndrome measures (e.g. apathy was not correlated with smell).

**Conclusions:** We found a convergence of measures within each frontal syndrome and a divergence between syndromes in PD.

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**K. STAVITSKY, E. GRIFFIN, P. MCNAMARA & A. CRONIN-GOLOMB. Objective measures of sleep quality and cognitive performance in Parkinson's disease.**

**Objective:** Sleep problems occur in over 75% of patients with Parkinson's disease (PD), with sleep fragmentation and decreased sleep efficiency among the most common sleep complaints. No studies have examined the association of sleep quality to cognitive performance in PD, though evidence from individuals with insomnia and community-dwelling older adults indicate a significant impact of disturbed sleep on neuropsychological performance. Studies report that deficits in sleep quality are associated with impairments in performance on tests of attention, concentration, and psychomotor speed as well as with overall mental status.

**Participants and Methods:** The study included 9 non-demented individuals with PD and 7 age-matched normal control participants (NC). Sleep disturbance was measured objectively using 24-hour wrist-actigraphy over a seven-day period. Measures included total sleep time, sleep efficiency, sleep latency, sleep fragmentation and total awake time. Cognitive testing was performed following the week of actigraphy and included tests of attention, concentration, executive function, memory and visuospatial functioning.

**Results:** For PD patients, less sleep efficiency and more wake time were significantly correlated with poorer performance on the digit span forward test. In addition, worse sleep quality was correlated with poorer performance on tests of verbal memory and executive functioning at an  $r > .50$ . PD patients displayed shorter total sleep time, worse sleep efficiency and greater sleep fragmentation than the control group.

**Conclusions:** This study confirms that in patients with PD, poor sleep quality is related to impaired performance on tests of attention, memory and executive function. These findings suggest a role for sleep disturbances in cognitive deficits commonly reported in PD.

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**J.J. TANNER, S.D. TOWLER, S.M. MITCHELL, D.M. MAHFOOD, C.C. PRICE & D.J. LIBON. The Impact of Gray and White Matter on Word Frequency of List-learning Intrusion Errors in Dementia.**

**Objective:** The impact that white matter and subcortical gray structures have on errors of verbal list learning is not well-understood. Specifically, MRI brain structure volume and white matter disruption identified as leukoaraiosis (LA) may differentially relate to the word frequency of list-learning intrusion errors.

**Participants and Methods:** 69 dementia patients were administered the Philadelphia (repeatable) Verbal Learning Test (PrVLT) and received neuroimaging. Intrusion error scores were classified according to word frequency based on the Francis and Kucera (1987) corpus. MRI

whole brain, ventricle, caudate, and LA volumes were calculated. A hierarchical regression was used to predict the word frequency of intrusion errors with brain factors as independent variables. Whole brain and ventricle volumes were entered first, caudate volume second, and total LA volume last.

**Results:** The best-fitting regression model (whole brain, ventricle, and caudate volumes) accounted for 19% of variance in word frequency of intrusion errors ( $F=4.78, p=.03$ ). Whole brain ( $B = -.37, p=.02$ ), ventricle ( $B = .48, p < .01$ ), and caudate ( $B = .29, p=.03$ ) volumes significantly predicted the word frequency of intrusion errors on the PrVLT. Total LA volume did not significantly predict performance.

**Conclusions:** Dementia patients with smaller total brain volume, larger lateral ventricle volume, and larger caudate volume, tended to produce intrusions that were more common words in the English language. Total LA was not related to word frequency of recall intrusions. This suggests impairment of associative semantic processes mediated by smaller cortical and larger subcortical volumes rather than white matter dysfunction. NINDS K23NS060660(CP), AlzAssociation IIRG0627542(DL)

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**A.I. TROSTER & J.A. FIELDS. Pre-Surgical Coping, Stressors, and Affective Distress and Quality of Life Outcome after Deep Brain Stimulation for Parkinson's Disease.**

**Objective:** Improvements in motor symptoms and younger age are linked to quality of life (QOL) gains after subthalamic (STN) deep brain stimulation (DBS) for Parkinson's disease (PD). Little attention has been devoted to pre-operative psychosocial correlates of QOL change despite recent concern that patients' psychosocial adaptation may not improve after DBS.

**Participants and Methods:** 31 PD patients underwent neuropsychological evaluation 1 month before and 4 months after bilateral STN DBS. Evaluation included the Life Stressors and Social Resources Inventory (LISRES), the Coping Responses Inventory (CRI), and a disease-specific QOL measure, the Parkinson's Disease Questionnaire (PDQ-39).

**Results:** Motor symptoms (UPDRS) and QOL improved significantly and there was no increase in stressors or decrease in resources. When patients were divided into those with lesser and greater QOL gains (above/below 22% or more/less than 10 PDQ points), those with greater QOL gains had better motor outcome. When QOL outcome was defined by percentage change, younger patients with earlier disease onset had a better outcome. When QOL was defined by absolute change, better outcome was experienced by those using more emotional discharge and logical analysis to cope with the disease and having more depressive symptoms and less support from family.

**Conclusions:** The study confirmed prior findings that QOL improves after STN DBS and that gains may be greater in younger patients. Increased psychosocial stress, as suggested by two prior studies, was not observed but follow-up was relatively short. Even among these patients without clinically significant stress, depression or cognitive dysfunction, QOL gains were associated with more pre-operative depressive symptoms and lesser support, and greater use of two coping mechanisms. Perhaps those with greater distress have fewer supports and are more self-reliant. This self-reliance may translate into patients capitalizing on opportunities afforded by motor symptom improvement and thus QOL gains.

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**C.Z. BURTON, S.A. IRWIN, L.C. DIAMOND, L.B. DUNN, B.W. PALMER, D.V. JESTE & E.W. TWAMLEY. Cognitive Impairment and Decision-Making Capacity in Hospice Care Patients.**

**Objective:** Cognitive impairment may be under-recognized in hospice populations, which can affect decision-making for medical treatment and end-of-life planning. This study aimed to better understand such issues among hospice patients.

**Participants and Methods:** Consecutively admitted patients at San Diego Hospice and Palliative Care were screened for eligibility; patients were excluded based on existing diagnoses of dementia or delirium, history of stroke, seizures, or other neurological disease or injury, non-English-speaking, or age under 18. Forty-six participants completed a neuropsychological battery that measured premorbid IQ, attention and working memory, verbal learning and memory, verbal reasoning, freedom from perseveration, verbal fluency, general cognitive functioning, and decision-making capacity.

**Results:** The mean age of participants was 65 years; mean education was 13 years. Forty-eight percent were men, 17% were members of ethnic minority groups, and 58% were diagnosed with cancer. The majority of participants were impaired (T-score <40) on verbal learning (72%), verbal reasoning (51%), and verbal fluency (letter fluency 64%; category fluency 69%). In addition, 40% met DSM-IV cognitive criteria for dementia, defined as impairment (T-score <40) in memory and at least one other cognitive domain. Lower performance on the decision-making measure was significantly correlated with both impaired verbal learning ( $r=0.40$ ,  $p=0.046$ ) and verbal reasoning ( $r=0.45$ ,  $p=0.029$ ), and was significantly related to the presence of cognitive dementia criteria ( $t=2.11$ ,  $df=22$ ,  $p=0.046$ ).

**Conclusions:** These results suggest that cognitive impairment is prevalent in hospice populations and may be associated with decision-making difficulty. Improved means of assessment for cognitive status and adaptation of information to enhance patient understanding may be important for end-of-life decision-making and medical care.

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**K.P. YOUNG, B. SPRINGATE, E. PREEN & R.F. KAPLAN. Cognitive Slowing In Amnesic Mild Cognitive Impairment.**

**Objective:** Amnesic Mild Cognitive Impairment (aMCI) is a relatively new diagnostic category used to describe isolated memory deficits in nondemented individuals. Although a decline in information processing speed coincides with normal aging, it is not clear if this is exaggerated in aMCI.

**Participants and Methods:** This study compared the performance of 20 clinically diagnosed aMCI patients (Mean age= 74.7, SD= 5.7) with 19 healthy elderly controls (Mean age= 78.9, SD=1.2) on the Wechsler Test of Adult Reading (WTAR), Repeatable Battery for the Assessment of Neuropsychological Status (RBANS), Trail Making Test (TMT), and the California Computerized Assessment Package (CalCAP), a computerized test of simple, choice and sequential reaction time (RT).

**Results:** There were no group differences on the WTAR. Although the aMCI group performed significantly ( $p < .05$ ) worse than controls on RBANS indices of immediate memory, language, attention, and delayed memory, only the memory indices were 1 SD or more below the average range, confirming the diagnosis. Performances on TMT (A and B) were slower in the aMCI group ( $p < .05$ ), although still within the average range. Simple RT and choice RT was significantly ( $p < .05$ ) slower in the aMCI group, although sequential RT did not differ. Choice RT and the delayed memory index were the only variables that entered a logistic regression model predicting group membership (classification accuracy >90%).

**Conclusions:** Individuals with aMCI show decrements in RT in addition to impaired memory. The definition of aMCI as purely a memory disorder may be a function of the tests used.

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## Other

**B.W. BECKER, C.G. LOWE, E. WOO, P.H. LU & J.L. CUMMINGS. Longitudinal Analysis of Cognition in Participants with Amnesic Mild Cognitive Impairment and Poor Insight into Memory and Mood.**

**Objective:** Poor metamemory, defined as insight into one's own memory functioning, is documented in the amnesic mild cognitive impair-

ment (aMCI) literature and may be linked with the prefrontal cortex and frontostriatal circuits. These regions are also responsible for completion of executive tasks, such as those involving cognitive flexibility. Persons with poor metamemory exhibit lower levels of depression. However, our recent work shows that low endorsement of depressive symptoms may be related to reduced insight into one's mood and memory. For this study, we examined whether poor insight into memory and mood is associated with greater deficits in cognitive flexibility.

**Participants and Methods:** Participants included 91 individuals with aMCI, who underwent a cognitive and psychiatric evaluation at study entry and then one year later. Participants were grouped based upon metamemory (Insight vs. No Insight) and mood (Insight vs. No Insight) awareness. Metamemory was measured using a discrepancy score between the aMCI participants' self-reported memory functioning and clinician diagnosis. Insight into mood was determined using a discrepancy score of depression ratings between the aMCI participants and the informant. Cognitive flexibility was assessed using the Trails B time to completion score.

**Results:** An (Metamemory, Mood Awareness, Time) ANOVA on Trails B, with repeated measures on the last factor, revealed a significant 3-way interaction for cognitive flexibility indicating a decline in Trails B performance after one year for participants with both poor metamemory and mood awareness. Trails B performance remained stable for groups that had intact insight, poor metamemory only, and poor mood awareness only.

**Conclusions:** These findings suggest that poor insight into memory and mood may represent subtle declines in frontal functions that are linked with cognitive decline in executive abilities.

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## Aging

**K.L. TRIEBEL, R.C. MARTIN, J. MARCEAUX & D.C. MARSON. Multivariate Models of Medical Decision-Making Capacity in the Prodromal Dementias of Alzheimer's Disease and Parkinson's Disease.**

**Objective:** To investigate models of Medical Decision-Making Capacity (MDC) in patients with possible prodromal dementias of Alzheimer's Disease (AD) and Parkinson's Disease Dementia (PDD).

**Participants and Methods:** The revised MCI criteria (Winblad, 2004) was used to diagnose MCI in both groups. The prodromal AD group (hereafter, aMCI) had amnesic MCI. The prodromal PDD group (hereafter, PD-MCI) had a diagnosis of idiopathic PD preceding diagnosis of MCI by at least one year, and had either amnesic or non-amnesic MCI. Scores on a vignette-based measure of MDC (Capacity to Consent to Treatment Instrument [CCTI]) were correlated with scores on cognitive and motor measures. Significant bivariate correlates ( $p < .05$ ) were subsequently entered into stepwise regression models to identify predictors of each CCTI consent standard. A 5:1 participant: predictor ratio was observed. Alpha was set at .05 for all analyses.

**Results:** Only cognitive measures emerged as significant predictors in the models for either MCI group. For the aMCI group, short-term verbal memory measures predicted performance on the most clinically relevant consent standard (*understanding*) and achieved cumulative  $R^2$  of .49 ( $p = .03$ ). In contrast, the PD-MCI model of *understanding* was comprised of executive function measures (cumulative  $R^2 = .77$ ,  $p = .03$ ).

**Conclusions:** These results indicate that there may be distinct models of MDC in prodromal stages of AD and PDD. A memory model emerged for aMCI versus an executive function model for PD-MCI. Conceptually, these differential models may reflect the distinct neuroanatomical pathways (i.e., fronto-striatal pathway in PD and hippocampal atrophy in AD) involved in the neurodegenerative processes of PD and AD.

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## Symposium 10: Basal Ganglia and Cognition

Chair: Anna Moore

Discussant: Frank Middleton

3:15–4:45 p.m.

A.B. MOORE, B. CROSSON, D. BOWERS, D. COPLAND, F. MIDDLETON & A. BRAATEN. **Basal Ganglia and Cognition.**

**Symposium Description:** The role of the basal ganglia in motor function has long been appreciated. However, the role of these subcortical structures for other facets of cognition has provoked considerable debate. Despite past controversy, the consolidated view of recent data on this topic confirms a role for basal ganglia in the modulation and execution of cognitive tasks including language, attention, and working memory. This symposium will bring together experts in basal ganglia function to discuss this topic, with an emphasis on language. Dr. Alyssa Braaten will present a case study of neuropsychological performance in a patient following a hemorrhage in the dominant hemisphere basal ganglia. This clinical case presentation creates a backdrop of relevance against which the following empirical presentations take place. Dr. David Copland will present on language effects of deep brain stimulation of the subthalamic nucleus with an emphasis on inhibition versus facilitation of language. Dawn Bowers' lab will present data highlighting differential findings from deep brain stimulation of the subthalamic nucleus versus the internal segment of the globus pallidus. Finally, there will be a presentation by Dr. Bruce Crosson examining basal ganglia function in recovery of language function after stroke. There is an exciting convergence of findings across these studies that mandates we revisit our schema about subcortical structures and cognition. Dr. Frank Middleton, who has carried out some of the seminal work on the circuitry of the basal ganglia, will serve as the Discussant.

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D. COPLAND, J.E. CASTNER, P.A. SILBORN, T.J. COYNE, F. SINCLAIR & H.J. CHENERY. **Subcortical Modulation of Language: Evidence from Stimulation of the Subthalamic Nucleus in Parkinson's Disease.**

**Objective:** Deep brain stimulation (DBS) of the subthalamic nucleus in Parkinson's Disease (PD) provides an opportunity to examine subcortical neuromodulation of language processing. DBS can significantly improve motor symptoms in Parkinson's disease (PD), yet the effects on language are uncertain.

**Participants and Methods:** Data will be presented on the effects of subthalamic DBS on different facets of language production in PD. Seventeen participants (13 males) diagnosed with PD were assessed at least four months after receiving bilateral STN DBS surgery. Each PD participant was tested with their stimulators turned on and off. The order of test condition was counterbalanced with at least 6 weeks separating the sessions. Twenty-one healthy matched participants acted as controls. Participants performed verbal production tasks measuring the ability to initiate a verbal response and to inhibit a dominant verbal response.

**Results:** Inhibition of a dominant response and generation of a novel response was impaired, relative to controls, in the DBS "off" condition, but improved in the "on" condition.

**Conclusions:** These findings will be considered in the context of other related DBS language studies and current models of frontal-subcortical function.

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A.E. MIKOS, M.S. OKUN, A. NOECKER, L. ZAHODNE, L. KIRSCH-DARROW, M. WON, C. MCINTYRE, K. FOOTE, H.H. FERNANDEZ & D. BOWERS. **DBS for Parkinson's: Dissection of the Effects on Cognition and Language.**

**Objective:** We examine the effects of deep brain stimulation, used to treat motor symptoms of Parkinson's disease, on language and cognition. Using several different patient samples and analytic procedures, we explore the effects of unilateral deep brain stimulation (DBS) of the subthalamic nucleus (STN) or globus pallidus internus (GPi). Discussion includes: 1) relative contribution of stimulation versus surgical lesion effects, 2) detection of individual-level cognitive decline using reliable change analyses, 3) implications of presumed DBS mechanisms on basal ganglia circuitry, and 4) effects of laterality and target of stimulation on cognitive performance.

**Participants and Methods:** Participants were drawn from two primary sources. First, we used a cognitive outcomes database to compare neuropsychological data from 24 unilateral DBS patients and 19 PD controls of similar age, education and disability level. Neuropsychological testing was performed prior to DBS and 16 months post surgery. Analysis of group-level changes from before to after surgery were conducted on tests of verbal fluency, memory, processing speed, executive functioning and visuospatial abilities. Individual-level change was investigated using reliable change indices. A second analysis was completed on 52 PD patients randomized to undergo unilateral DBS implantation of either the STN or GPi (PI: MSO). Following surgery, patients' verbal fluency performance was assessed under four different conditions: ON optimal stimulation, with stimulation of the dorsal contact, with stimulation of the ventral contact, and OFF stimulation.

**Results:** Based on neuroimaging and microelectrode recording data, we developed computer-generated models of DBS effects for each patient. These patient-specific models allowed investigation of the relationship of the volume and locus of stimulation with cognitive performance.

**Conclusions:** Data derived from these approaches will be discussed with special reference to basal ganglia influence on cognitive and language behavior.

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A.J. BRAATEN & A.Y. STRINGER. **Language Impairments Following Basal Ganglia Stroke: Hold and Release Functions in Cognition.**

**Objective:** The basal ganglia, a cluster of nuclei embedded deep within the cerebral hemispheres, are estimated to be affected in up to 60% of patients with intracerebral hemorrhagic stroke (Su et al., 2007). While long considered to be a primary motor center within the brain, neuropsychological studies have drawn increasing attention to the basal ganglia's role in cognition. The basal ganglia do not directly mediate cognitive function, but rather play a regulatory role, inhibiting some cognitive activities while enhancing others. More specifically, the basal ganglia enhance target cognitive activities while suppressing competing activity (Crosson, Benjamin, & Levy, 2007). This enhancement of cognitive activity may be conceptualized as a "release" function, in that it permits activity to occur. The suppression of competing activity may be conceptualized as a "hold" function in that activity is prevented from occurring. The cognitive functions of the basal ganglia and a model of the basal ganglia's role in language will be explored in the context of a patient with a left basal ganglia hemorrhagic stroke.

**Participants and Methods:** J.K., A 70 year old, right handed, Middle Eastern male, who experienced a left basal ganglia hemorrhagic stroke. The participant was administered a full neuropsychological battery.

**Results:** J.K. demonstrated significant impairment on a number of measures, specifically with regards to verbal learning and memory, naming, and problem-solving. Of most interest were an unusual number of bizarre errors of intrusion and apparent difficulty with the inhibition of inappropriate verbal responses.

**Conclusions:** J.K.'s performance is a demonstration of the basal ganglia's role in excitation and inhibition.

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### **B. CROSSON, M. BENJAMIN & Z. ZLATAR. Do the Basal Ganglia Have a Role in Aphasia Recovery and Rehabilitation?**

**Objective:** Although basal ganglia damage alone does not cause aphasia (Hillis et al., 2002), left basal ganglia damage causes executive language dysfunction (Copland et al., 2000), and left basal ganglia in addition to cortical damage decreases recovery from aphasia (Brunner et al., 1982). We previously applied motor models of basal ganglia function to language and suggested that the role of the basal ganglia in executive language functions was to enhance selected behaviors and suppress competing behaviors, boosting signal to noise ratios in the cortex and increasing efficiency of expression (Crosson et al., 2007). Suppression of competing behavior in neurologically normal subjects includes limiting right frontal activity during word generation, keeping it from interfering with left frontal functions (Crosson et al., 2003). According to this model, the left basal ganglia may suppress activity in structures that interfere with language output during recovery and rehabilitation, enabling the brain to establish new networks to optimize language recovery.

**Results:** Group data from our laboratory indicate that left basal ganglia damage impedes aphasia rehabilitation (Parkinson, 2005). Case studies from our laboratory indicate that left basal ganglia damage may limit reorganization and that an intact left basal ganglia may play some role in reorganization of function during rehabilitation (Crosson et al., 2005).

**Conclusions:** Recent data from our laboratory with a bearing on the role of the basal ganglia in aphasia rehabilitation will be discussed, and alternative models will be considered.

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## **Paper Session 10: Epilepsy/Seizures**

**3:15–4:45 p.m.**

**M. CHEUNG, A.S. CHAN, J.M. LAM & Y. CHAN. Post-surgical memory function associated with left mesiotemporal functional MRI activation in patients with right temporal lobe epilepsy.**

**Objective:** To examine and compare the memory function and memory processing in patients with right temporal lobe epilepsy (right-TLE) before and after temporal lobectomy using functional MRI.

**Participants and Methods:** Eight pre-operative patients with right-TLE and eight healthy controls were recruited. They performed a complex visual scene-encoding task during functional MRI to measure memory activation in the mesial temporal lobe. Their memory performance was evaluated using standardized neuropsychological tests. One year after temporal lobectomy, the same functional MRI paradigm and neuropsychological tests were administered to the patient group.

**Results:** Compared with normal control, right-TLE patients showed deficit in visual memory ( $p = 0.003$ ) and demonstrated significantly less activation in the bilateral mesial temporal lobe before surgery. The reduced activation was observed in both the left and right mesial temporal lobe (left,  $p = 0.042$ ; right,  $p = 0.006$ ). One year after temporal lobectomy, although no significant decline in visual memory was found in right-TLE patients ( $p > 0.05$ ), reduction in memory activation ( $p <$

$0.001$ ) was found in the mesial temporal lobe ipsilateral to resection, including the right parahippocampal gyrus, right hippocampus and right fusiform gyrus. The post-surgical verbal and visual memory of right-TLE patients were positively correlated only with memory activation in the left (verbal,  $r(7) = 0.833$ ,  $p = 0.020$ , visual,  $r(7) = 0.966$ ,  $p = 0.000$ ) but not right mesial temporal lobe.

**Conclusions:** The present study demonstrated that post-operative memory function was significantly associated with mesiotemporal functional activation contralateral to temporal lobectomy in patients with right-TLE. Therefore, the function of the contralateral mesial temporal lobe was essential to support memory performance after surgery.

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**M.D. BARKER, G.Z. RECKESS, B.C. SACHS, J. ROBSON, D. LORING, E. FENNELL, S.N. ROPER & R.M. BAUER. Transitive Inference in Post-Surgical Patients with Temporal Lobe Epilepsy.**

**Objective:** Recent findings in cognitive neuroscience reveal that transitive inference (TI) tasks, which require the recognition of associations across experiences, successfully measure hippocampal functioning. Extant research has focused on animals and healthy adults. This study is the first to apply this well-validated paradigm to patients with temporal lobe epilepsy (TLE).

**Participants and Methods:** Participants included 26 patients with TLE who had undergone anterior temporal lobectomy (left  $n=9$ , right  $n=17$ ) and 19 healthy controls. They completed a computer-based TI task adapted from Heckers and colleagues (2004), which has been shown to selectively activate the right hippocampus during functional imaging. During training, participants view pairs of patterned shapes and learn the "winner" in each pair (e.g., A>B, B>C, C>D, D>E). They are then tested on their ability to recollect the correct response for previously seen pairs and to make inferences about novel pairings (e.g., B>D).

**Results:** The critical condition in this task requires participants to remember and make inferences across a series of overlapping pairs that form a hierarchy (A>B>C>D>E). Large within group variability in performance was observed. Preliminary analyses using a series of ANOVAs revealed no group differences in memory for learned pairs. However, a significant group difference ( $p < .05$ ) was detected for inferences across pairs in the TI condition, with right TLE patients performing worse than controls.

**Conclusions:** Patients with right TLE showed poorer performance on TI for visually presented information. This task shows potential to be sensitive to hippocampally-mediated memory dysfunction. The clinical utility of this task relative to standard neuropsychological tests will be discussed. Correspondence: *Marie D. Barker, M.S., Clinical and Health Psychology, University of Florida, 40-A Berkeley Road, Charleston, SC 29407. E-mail: m.barker@phhp.ufl.edu*

**B. HERMANN, K. DABBS, A. MYERS Y GUTIERREZ, J.E. JONES, T. BECKER, R. SHETH, G. WENDT, A. FIELD & M. SEIDENBERG. Brain Development in New Onset Pediatric Epilepsy: A Longitudinal Study.**

**Objective:** Longitudinal quantitative magnetic resonance imaging (MRI) investigations of healthy children demonstrate age and region-specific declines in cerebral gray matter with concomitant increases in cerebral white matter volumes, findings that reflect cortical pruning and myelination respectively. These normal neurodevelopmental patterns can be disrupted in some childhood disorders. Epilepsy is a prevalent neurological disorder of childhood onset, but its impact on brain development has not been examined and was the subject of this investigation.

**Participants and Methods:** A consecutive series of 38 children with new onset idiopathic epilepsy and 34 healthy first degree cousin controls, age 8-18, underwent baseline and two year prospective MR imaging with assessment of total and lobar cerebral gray and white matter volumes. Images were obtained on a 1.5 Tesla GE Signa MR scanner and were processed using the Brains2 software package.

**Results:** A significant prospective two year decrease in total cerebral gray matter volume was observed in the control ( $p < .001$ ) and epilepsy

( $p < .001$ ) groups with no significant group difference ( $p = .94$ ). In contrast, controls ( $p = .0012$ ) but not epilepsy subjects ( $p = .52$ ) exhibited a significant increase in cerebral white matter volume. Inspection of group by cerebral lobe white matter changes revealed a significant interaction effect for the frontal lobes ( $p = .04$ ), with nonsignificant trends in the same direction for the temporal and parietal lobes.

**Conclusions:** Patterns of brain development are altered in the first two years after onset of idiopathic epilepsy with reduced white matter development in children with epilepsy, an effect that is most prominent in the frontal lobes.

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P.S. FASTENAU, C.S. JOHNSON, A.W. BYARS, S.M. PERKINS, T.J. DEGRAUW, J.K. AUSTIN & D.W. DUNN. Relationship Among Seizure Recurrence, Antiepileptic Drug Use, and Neuropsychological Functioning in Children Following the First Recognized Seizure.

**Objective:** To examine the independent contributions of seizure recurrence and antiepileptic drugs (AEDs) to neuropsychological functioning in a drug-naïve cohort.

**Participants and Methods:** This large community-based drug-naïve new-onset cohort of 301 children (ages 6–14 years; 51.5% female; IQ  $M = 101.0$ ,  $SD = 15.4$ ) completed neuropsychological and academic achievement tests within 6 months ( $M = 2.9$ ,  $SD = 1.4$ ) of their first seizure. Seizure recurrence was coded 1 vs. 2+ unprovoked seizures; AED use was coded on-AED vs. never medicated. Four neuropsychological factors (Language, Processing Speed, Verbal Memory/Learning, Attention/Executive/Construction) were subjected to a 2x2 (Seizure Recurrence x AED Use) ANOVA yielding four subgroups: No Recurrence/No AED,  $n = 95$ ; No Recurrence/On AED,  $n = 35$ ; Recurrence/No AED,  $n = 50$ ; Recurrence/On AED,  $n = 120$ .

**Results:** There was a main effect for AED use on Language, Processing Speed, and Verbal Memory/Learning; children prescribed AEDs scored lower on these factors *irrespective* of whether or not the child had had a recurrent seizure. In addition, there was a main effect of seizure recurrence on the Attention/Executive/Construction index; that is, children who had had a second seizure scored lower on this index, *irrespective* of whether or not the child had been prescribed AEDs. The groups did not differ in any area of academic achievement.

**Conclusions:** Seizure recurrence was associated with attention, construction, and executive inefficiencies, consistent with other studies in children with epilepsy. AEDs were associated with Processing Speed, Language, and Verbal Memory/Learning deficiencies *independent* of seizure recurrence, which is surprising because many studies report minimal cognitive deficits with most AEDs in monotherapy and because only 6 children were prescribed phenobarbital or topiramate. Seizure recurrence and AEDs present unique risks to cognitive development. This study design does not lend itself to systematic examination of individual AEDs. (Funded by NIH NS22416 to JKA)  
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M.A. PROSJE, A.J. BRAATEN & A.Y. STRINGER. Reassessing the Use of Line Drawings in the Wada Test: Deviation From Baseline and Seizure Laterality.

**Objective:** During the Wada Test (WT), objects are reportedly superior to drawings in lateralizing temporal lobe epilepsy (TLE) impairment. Drawings, however, offer advantages as they are readily standardized and matched for difficulty. Utilizing a new procedure for determining impairment laterality, we reassessed the discriminative power of drawings during the WT.

**Participants and Methods:** Sixty-four right and 58 left TLE surgery candidates that did not differ on potential confounding variables participated. All underwent a WT (epileptic hemisphere first, 40 minute washout, then non-epileptic hemisphere) utilizing a 125 mg. internal carotid amobarbital injection and three sets of difficulty-matched line drawings (4 targets, 4 similar and 8 dissimilar foils) that provided alternate forms for assessing baseline and post-injection memory. Stimulus presentation began after 50% reduction in EEG slow wave activity. Recognition memory testing was at 12-minutes post-injection. Number of correct responses to targets and related foils was summed, with 1/2 point deducted for each incorrect response to unrelated foils. Percent deviation from baseline memory was calculated for each hemisphere.

**Results:** Epileptic hemisphere memory (EHM) deviated more from baseline than did non-EHM ( $t = -8.433$ ,  $p < .001$ ). EHM was greater than non-EHM deviation for both left ( $p < .002$ ) and right ( $p < .001$ ) TLE groups and groups did not differ in EHM memory deviation. Groups did differ, however, in non-EHM deviation which tended to be greater in left TLE ( $p < .001$ ).

**Conclusions:** Using deviation from baseline scores, memory for drawings successfully detected left and right TLE impairment, although left TLE patients also had non-EHM impairment. Memory for drawings should be reconsidered for use in the WT.

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## Presidential Address: Understanding Developmental Neurogenetic Disorders: A Transdisciplinary Approach

President: Jack Fletcher

5:15–6:15 p.m.

J. FLETCHER. Understanding Developmental Neurogenetic Disorders: A Transdisciplinary Approach.

As a neuropsychological disorder, spina bifida presents with considerable variability and heterogeneity, especially at the cognitive level. To understand this variability, an interdisciplinary perspective is needed that addresses genetic, environmental, and neural sources of heterogeneity and their impact on neuropsychological outcomes. A modal neuropsychological profile can be described but is variable. The variability is related to the physical and neural phenotypes, which in turn are related to the genotype and environment. Future research in neuropsychology will depend heavily on the capacity of the neuropsychologist to work productively with other disciplines and integrate information across scientific domains.

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## SATURDAY MORNING, FEBRUARY 14, 2009

## Paper Session 11:

## Pyschopathology/Neuropsychiatry: Schizophrenia

9:00–10:30 a.m.

**N. OJEDA, J. PEÑA, P. SÁNCHEZ, E. ELIZAGARATE, A. YOLLER, J. EZCURRA & M. GUTIERREZ FRAILE. Longitudinal Cognitive Changes In Chronic Schizophrenia: The Role Of Processing Speed.**

**Objective:** We aimed to identify best predictors of cognitive and functional disability in chronic schizophrenia over time.

**Participants and Methods:** We examined 95 hospitalised patients with schizophrenia in a long stage unit (DSM-IV criteria) and 53 healthy controls (matched for age, gender, and years of education). Neuropsychological assessment included tests for Verbal Memory, Working Memory, Executive Functioning and Processing Speed. Functional Disability was assessed with the Disability Assessment Schedule (DAS-WHO) both at baseline and 6 months after.

**Results:** As expected, patients performance was significantly lower than healthy comparison subjects on all neurocognitive variables at baseline. Most, but not all, neurocognitive measures were positively correlated with the Functional Disability domains at follow up, including Self Care Management, Vocational Outcome, Family Contact and Social Competence. Results of mediation analyses suggest that all significant relationships identified between cognitive measures and functional outcome were significantly mediated by the Index Processing Speed with various effects ((between  $p < 0.05$  for PS ( $z = -2.06$ ) and  $p < 0.01$  for PS ( $z = -3.01$ )).

**Conclusions:** Our data show that Processing Speed plays a determinant role in the relationship among neurocognitive symptoms and Self Care, Vocational Outcome and Social Competence. The predictor model emphasizes his role as the best longitudinal predictor of the level of autonomy in chronic patients with schizophrenia where PS acts as a pathway through which VM, EF and WM predict the course of patients functional ability over time.

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**N. OJEDA, J. PEÑA, P. SANCHEZ, E. ELIZAGARATE, A. YOLLER, M. GUTIERREZ FRAILE & J. EZCURRA. The Role Of Sociodemographic, Clinical And Neuropsychological Symptoms On Quality Of Life In Chronic Schizophrenia.**

**Objective:** To examine the relative contributions of psychiatric symptoms, functional disability, neuropsychological functioning and sociodemographic variables to quality of life (QOL) in patients with chronic schizophrenia.

**Participants and Methods:** We examined 165 hospitalised patients with long term schizophrenia (DSM-IV). Measures of psychiatric symptoms included depression (Calgary depression Scale), insight (David Insight Scale), symptom severity (BPRS) and PANSS (Positive and Negative Symptom Scale). Neuropsychological battery included tests for verbal memory, executive functioning, verbal fluency, working memory, motor speed and processing speed. Functional disability was assessed with the Disability Assessment Schedule (DAS-WHO) and Quality of life was assessed with the Quality of Life Scale.

**Results:** Age, years of evolution, negative symptoms, insight and neuropsychological variables (except motor speed) all were significantly related to level of quality of life. In a multiple regression analysis, entering the neuropsychological functioning, functional disability and negative symptoms generated a model which accounted for a 74.9% of the variance in QOL. Functional disability, as expected, accounted for 56% of the variance, whereas Processing Speed explained an additional 6.2%. Symptom Severity and Ver-

bal Fluency predicted 3.7 and 3.5% of the variance, respectively. Negative symptoms, Verbal Memory and Vocabulary, were also significant predictors in the model, but had less predictive value. However, Positive Symptoms and Sociodemographic Variables did not significantly contribute to predict quality of life.

**Conclusions:** Our findings support the predictive value of neuropsychological functioning and severity of clinical symptoms in long term quality of life in schizophrenia.

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**D.R. COMBS, M.R. BASSO, J. WAGUSPACK, D. CHAPMAN, K. LAIB, B. WAITS, C. RENEAU & J. GRIFFITHS. The Role of Neuropsychological, Social Cognition, and Symptoms in the Prediction Of Social Functioning in Schizophrenia.**

**Objective:** Recent models of social functioning in schizophrenia posit important roles for neurocognition, positive and negative symptoms, and emotion perception (Green et al., 2000). However, the relationship among these different constructs is unclear due to the overlap between the variables (Penn et al., 2006). Also, researchers are interested in which variables best predict social functioning, thereby permitting development of more effective interventions (Combs et al., 2007). In this study, we examined the role of neurocognition, schizophrenia symptoms, and emotion perception in predicting social functioning. Also, we determined which neuropsychological variables predict emotion perception based on research that emotion perception is largely mediated by intact attentional skills (Combs & Gouvier, 2004).

**Participants and Methods:** Our sample consisted of 60 inpatients with DSM-IV-TR schizophrenia as measured by the SCID. All participants completed the RBANS, Facial Emotion Identification Test (FEIT), Bell-Lysaker Emotion Recognition Test (BLERT), Benton Test of Facial Recognition, Benton Visual Form Recognition Test, and Brief Psychiatric Rating Scale (BPRS). The primary outcome measure was the Social Functioning Scale completed by 2 staff raters.

**Results:** A series of regression analyses were performed. In the prediction of social functioning, emotion perception (FEIT), BPRS thought disorder, RBANS attention, and the Visual Form Recognition Test emerged as significant predictors ( $R^2 = .468$ ). Emotion perception scores were predicted by RBANS attention and BPRS thought disorder ( $R^2 = .468$ ).

**Conclusions:** Attentional skills appear to be important in both social functioning and emotion perception. Results will be interpreted in light of recent models of social competence in schizophrenia.

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**J. PENA, N.G. CASCELLA, V.A. RAO, N. OJEDA, G.D. PEARLSON & D.J. SCHRETLEN. Confirmatory Factor Analysis Reveals a Latent Cognitive Structure Common to Schizophrenia, Bipolar Disorder, and Unaffected Adults.**

**Objective:** We sought to determine whether the same hypothesized latent factors would characterize the cognitive functioning of three distinct groups.

**Participants and Methods:** We assessed 576 adults (340 community controls, 110 patients with schizophrenia, and 126 with bipolar disorder) using 15 measures derived from 9 cognitive tests. Confirmatory factor analysis was used to examine the fit of a 6-factor model. The hypothesized factors include attention, psychomotor speed, verbal memory, visual memory, ideational fluency and executive functioning.

**Results:** The 6-factor model provided an excellent fit for the entire sample (RMSEA = 0.05, NNFI = 0.99, CFI = 0.99). The same hypothesized factor structure was also found to fit all three sub-samples: community controls (RMSEA < 0.05, NNFI = 0.98, CFI = 0.99), patients with bipolar disorder (RMSEA = 0.07, NNFI = 0.96, CFI = 0.99) and patients with schizophrenia (RMSEA = 0.06, NNFI = 0.97, CFI = 0.98). Alternate models that combined fluency with processing speed and combined verbal with visual memory reduced the goodness of fit.



**Conclusions:** Confirmatory factor analysis supported a 6-factor structure of cognitive functioning across a large sample of patients with schizophrenia or bipolar disorder and community controls. These findings provide the first known confirmation of a common latent structure of cognitive functioning, and suggest that the three groups differ in level of performance but not organization of information processing. These separable factors of cognitive functioning could provide useful targets for clinical trials of molecules developed to enhance aspects of information processing in patients with neurological and neuropsychiatric disorders.

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**E.W. TWAMLEY, C.Z. BURTON, L. VELLA, G.N. SAVLA, M. ABELES, R.M. BILDER & J.R. KELSOE. COMT, Cognition, and Functional Capacity in Schizophrenia.**

**Objective:** A single nucleotide polymorphism (Val158Met) of the catechol-O-methyltransferase (COMT) gene on chromosome 22 influences dopamine catabolism and may be related to cognitive impairment in schizophrenia. Previous studies have found that the Met allele is associated in a dose-response fashion with better performance on most neuropsychological tests except those measuring cognitive flexibility/switching.

**Participants and Methods:** We assessed 73 outpatients with schizophrenia-spectrum disorders (63% men; 78% Caucasian; mean age = 47; mean years of education = 13) with a blood draw and a comprehensive neuropsychological, functional, and clinical battery. Participants with the Val/Val (n=24), Val/Met (n=32), and Met/Met (n=17) genotypes did not differ on demographic variables, diagnosis, type of antipsychotic medication, or duration of psychosis.

**Results:** Spearman correlations between the “dose” of the Met allele (0, 1, or 2 Met alleles) and the neuropsychological, functional, and clinical variables demonstrated that a higher number of Met alleles was associated with better verbal processing speed (Category Fluency), abstract reasoning (DKEFS Card Sorting test), switching (DKEFS Trails Switching and Trails Switching vs. Number Sequencing), and functional capacity (UPSA). Group means suggested that the Val allele was not associated with better performance on any indicators of switching, inhibitory control, or any other neuropsychological domain.

**Conclusions:** These results suggest that the Met allele is associated with better performance across multiple neuropsychological domains and functional capacity tasks. Given that the Val158Met polymorphism typically explains a small amount of variance in cognitive performance and given the small size of the current sample, these results need to be replicated with a larger sample.

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**Invited Plenary:  
Tourette Syndrome: The Self under Siege**

**Speaker: James Leckman**

**9:00–10:00 a.m.**

**J. LECKMAN. Tourette Syndrome: The Self under Siege.**

Tourette syndrome (TS) is childhood onset neurodevelopmental disorder characterized by motor and vocal tics as well as frequent comorbid attention deficit hyperactivity disorder (ADHD) and obsessive-compulsive disorder (OCD). This presentation will provide an update concerning the phenomenology and natural history, genetics, neurobiology and treatment of TS. Advances over the past several years include a deeper understanding of the premonitory sensory urges and sensori-mo-

tor gating abnormalities seen in TS as well as its neuroanatomical substrates and associated neuropsychological abnormalities, particularly deficits in procedural memory, visual-motor integration, and fine motor skill. A majority of individuals with TS show a significant improvement by the end of the second decade of life although the sensori-motor deficits may remain despite the remission of tics. Emerging data point to the potential value of neuroanatomical and neuropsychological findings, obtained in childhood, as predictors of future tic and OCD outcomes assessed in early in adulthood. Smaller caudate volumes are associated with worse tic and OCD outcomes. Remarkably, higher IQ values are associated with the occurrence of comorbid OCD. In addition to less than ideal pharmacological interventions, behavioral interventions, particularly habit reversal training, have been shown to be of value in children and adolescents with moderate tic severity. For adults with severe TS, repetitive transcranial magnetic stimulation (rTMS) and deep brain stimulation (DBS) may be of significant benefit. The neuroanatomic targets for rTMS (the supplementary motor area) and DBS (midline thalamic nuclei and the globus pallidus, pars internus) re-enforce our present model of the neuroanatomy and electrophysiology of TS. However, despite significant progress, much remains to be learned before we gain a full understanding of the complex, challenging, enigmatic, internal world that is TS.

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**Poster Session 10:  
Adult Assessment, Forensics, Laterality**

**9:00–10:30 a.m.**

**Assessment/Psychometrics/Methods  
(Adult)**

**L. AGUERREVERE, K.W. GREVE, K.J. BIANCHINI, J.S. ORD, R.J. HEINRICHS, D.K. SOETAERT & C.D. MORGAN. Classification Accuracy of the Millon Clinical Multiaxial Inventory-III in the Detection of Malingering in Traumatic Brain Injury.**

**Objective:** The Millon Clinical Multiaxial Inventory is a commonly used as a measure of self-reported psychopathology. The MCMI-III provides three modifier indices designed to detect over- and under-reporting of symptoms. Unlike the MMPI-2 validity scales, the ability of the MCMI modifying indices to detect malingering is not known. The present study used Criterion Group Validation to determine the ability of the MCMI-III modifier indices to detect malingering in Traumatic Brain Injury (TBI).

**Participants and Methods:** Data were collected from 108 TBI patients referred for neuropsychological evaluation, most seen in the context of financial incentive. Data from 485 hospitalized psychiatric patients were included for comparison. BR scores were used for MCMI-III modifier indices: Disclosure, Desirability and Debasement. Malingering classification was based on the Slick et al. (1999) criteria for Malingered Neurocognitive Dysfunction (MND). TBI patients were placed in one of three groups: MND (n = 55), not-MND (n = 26), or Indeterminate (n = 26).

**Results:** The not-MND group scored lower than the MND and the psychiatric groups, which did not differ from each other. At scores associated with 4% False Positive (FP) rate sensitivity was 47% for Disclosure, 51% for Desirability, and 55% for Debasement. Examining joint classification analysis identified 64% of MND at cutoffs associated with a combined FP rate of 12%.

**Conclusions:** Results suggested that scores from all MCMI-III modifier indices are useful for identifying malingered performance in TBI. However, using the scales jointly may not offer much incremental validity over the performance of most sensitive of the three scales. Clinical implications are discussed.

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**G. ARAUJO, N.J. SCHWARZE & D.A. WHITE. An Examination of the Validity of the Ruff-Light Trail Learning Test.**

**Objective:** The Ruff-Light Trail Learning Test (RULIT) is a neuropsychological measure of visuospatial learning and memory designed to be sensitive to right lateralized brain dysfunction. We examined the validity of the RULIT in patients with right-mesial temporal lobe epilepsy (RMTLE) and left-mesial temporal lobe epilepsy (LMTLE) by analyzing between-groups differences in RULIT scores, and by comparing RULIT scores within each group to concurrently and discriminately administered neuropsychological tests.

**Participants and Methods:** Data from 52 patients were analyzed. The group comprised 32 patients with LMTLE from 21-61 years of age, and 20 patients with RMTLE from 21-62 years of age. All patients completed the RULIT, California Verbal Learning Test – 2nd edition (CVLT-II), Boston Naming Test (BNT), and the visual reproduction (VR) and logical memory (LM) subtests of Wechsler Memory Scale – 3rd edition (WMS-III).

**Results:** Contrary to expectation, RULIT T-scores were significantly higher for patients with RMTLE than patients with LMTLE for immediate recall on the RULIT (RMTLE = 46, LMTLE = 40,  $p < .05$ ). Within the RMTLE group, RULIT scores correlated significantly with only visual memory (VR) scores. Within the LMTLE group, however, RULIT scores correlated significantly with both verbal (CVLT-II, LM) and visual memory (VR) scores.

**Conclusions:** Findings from our study suggest that the RULIT may not be uniquely sensitive to right hemisphere brain dysfunction. Additionally, the pattern of correlations observed within each group suggests that the ability to verbally mediate the task may positively affect performance on this measure.

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**T.M. ATKINSON, J. ASHLIN, M. FREEDBERG, D. HART, A. HOUGHTON, J. MURPHY & J.P. RYAN. Error Analysis in Tests Measuring Sequencing-Shifting Abilities.**

**Objective:** Errors made by test takers during administration of the classic Trail Making Test (TMT) and its variants have been widely overlooked in the literature, yet can potentially provide clinicians with supplemental information when making diagnoses and planning interventions. It was proposed that individuals taking such tests commit two unique types of errors: sequencing errors, which occur when a participant selects the incorrect target as being next in the series of responses, and loss of cognitive set errors, defined as occurring when an individual fails to alternate between stimuli (e.g., letters and numbers) despite instructions to do so.

**Participants and Methods:** Data from two studies that explored the construct validity of four variants of the TMT in undergraduate psychology students aged 18-23 ( $N = 169$  and  $182$ ) were scored for instances of sequencing errors and loss of construct errors. This two factor structure was then tested against alternative models within a confirmatory factor analysis framework.

**Results:** Fit indices provided evidence that the two factor (sequencing errors and loss of construct errors) structure was best representative of the data when compared to single factor and three factor models. This two factor structure was invariant across the counterbalanced order of administration groups in both studies.

**Conclusions:** The present results can provide clinicians and researchers with operational definitions of two distinct types of errors that can be made during this form of neurocognitive assessment of sequencing and shifting. This information can prove useful when tracking patient recovery from brain injury over time or making single-case interpretations.

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**C.L. BURROWS, M. HISCOCK & J.S. CAROSELLI. Individual Differences in Performance on the Iowa Gambling Task: Effects of Knowledge and Experience on Decision Making.**

**Objective:** The Gambling Task (GT) is a laboratory task designed to simulate real-life decision making. This study attempts to reconcile the somatic marker hypothesis with evidence that young adults tend to make risky choices on the GT (Caroselli et al., 2006). The performance of young adults on the GT is examined in relation to subjective deck preferences and reinforcement outcomes.

**Participants and Methods:** A computerized version of the GT was administered to 150 participants (75 females, 75 males). Participants rated their feelings about each of the four decks after trials 20, 40, 60, 80, and 100.

**Results:** Although participants' ratings favored the non-risky decks, they continued to make a large number of risky selections, which indicates a dissociation between their knowledge and choices. This is also reflected in the modest correlation between deck ratings and selections ( $r = .31$ ). Positive reinforcement outcomes by Trial 60 were associated with non-risky deck selections on the final 40 trials ( $r = .33$ ). By Trial 60, 104 of the 150 participants (69%) had experienced better outcomes from the non-risky decks than from the risky decks, and these participants were more likely to favor the non-risky decks in their ratings.

**Conclusions:** Undergraduates perform poorly on the GT, frequently selecting risky decks even while giving more favorable ratings to non-risky decks. Thus, young adults demonstrate some awareness of the consequences of their choices but they often do not act in accordance with that knowledge. Participants' early reinforcement outcomes are also associated with their decisions on the final trials of the GT. Participants' individual experience seems to have guided their selections rather than objective knowledge of the decks, as many participants benefited from making risky decisions. These findings do not rule out the role of somatic markers, but other factors should also be considered.

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**F.W. BYLSMA & T. BYLSMA. Predicting Trail Making Test Part B Completion Time.**

**Objective:** To determine an accurate, reliable method to predict overall Trail Making Test (TMT) Part B completion time based upon measures derived from a discontinued performance.

**Participants and Methods:** 57 patients with known brain injuries of various etiologies (e.g., stroke, trauma) were administered the TMT Parts A & B according to the standard administration protocol. Standard completion time (TMT-A time, TMT-B time) & error count measures (TMT-A errors, TMT-B errors) were recorded. Also, completion time and number of errors committed to reach the number 10 on Part A (TMT-A-10 time & errors) and the letter E on Part B (TMT-B-E time & errors) were recorded. Stepwise linear regression was used to derive a prediction equation to estimate Part B completion times. Possible predictor variables were TMT-A time, TMT-A errors, TMT-A10 time, TMT-A10 errors, TMT-B-E time and TMT-B-E errors; TMT-B time was the criterion variable.

**Results:** A significant prediction model for TMT-B time ( $R$ -square = 0.70,  $F(2,56) = 63.8$ ,  $p < .001$ ) was achieved using 2 predictor variables — TMT-A time and TMT-B-E time. TMT-B-E time was the best predictor ( $R$ -square = 0.59,  $p < .001$ ), and TMT-A time significantly increased  $R$ -square by 0.11 ( $p < .001$ ). No other predictor variables explained sufficient variance to enter the equation.

**Conclusions:** A reasonable estimate of TMT-B completion time can be achieved using partial performance, provided that the person completes

Part A and Part B to the letter E. Though not likely to provide additional clinical information over that of knowing the person discontinued Part B, this method may serve to preserve TMT-B data for research purposes. Typically, an incomplete TMT performance results in a subject's data being eliminated from statistical analyses involving that variable. Use of a reliable and valid estimate of TMT-B performance for such cases could potentially reduce lost data points for these analyses. A cross validation study of the equation with an independent sample of patients is underway.

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#### **F.W. BYLSMA, T. BYLSMA & T. SCHIRMER. Time to Respond on the Boston Naming Test (BNT).**

**Objective:** To determine whether shortening the standard 20-second response intervals on the Boston Naming Test (BNT) to a 5-second interval would affect overall BNT performance in a clinically relevant way.

**Participants and Methods:** 37 patients (19 M, 18 F; Mean age = 55 +/- 16.8 years) with moderate to severe brain injuries of various etiologies were administered the 60-item BNT according to standard methods — though always starting at item 1. Spontaneous responses were coded as occurring in less than 5 seconds or between 6-20 seconds after stimulus presentation. The protocols were first scored according to standard methods, and clinical severity ratings were applied to the normed scores. Then, total BNT scores were generated based only on those answers given on less than 5 seconds (BNT<5), and clinical severity ratings were applied to those data. The two scoring methods were compared for BNT total scores and for the number of patients assigned specific clinical rating categories.

**Results:** BNT and BNT<5 scores were significantly correlated ( $r = 0.99$ ,  $p < .001$ ). BNT<5 total scores ( $M = 19.7$ ,  $SE = 3.0$ ) and standard BNT total scores ( $M = 23.1$ ,  $SE = 3.2$ ) were statistically significantly different (Paired  $t$ -test:  $t(36) = 19.6$ ,  $p < .001$ ). Five patients (13.5%) were assigned a higher clinical rating with the standard 20-second interval than with a 5-second response interval. However, each of those 5 patients had scored at the cusp of a clinical rating interval with the 5-second response time.

**Conclusions:** A shorter response interval for BNT items resulted in a decline in total score of about 3 items in this group of patients with moderate to severe brain injuries. However, few patients changed clinical severity rating categories as a result. Therefore, a 20-second response interval may not be necessary, potentially shortening the time to administer the BNT significantly.

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#### **K. CAPPA & J. CONGER. Evaluation of the Cognitive Log as a Predictive Measure of Outpatient Neuropsychological Testing.**

**Objective:** The Cognitive Log (Cog-Log; Alderson & Novack, 2003) was designed to measure the orientation, memory, praxis, and executive functioning of head injured inpatients. The current study was designed as a partial replication of the Lee, LoGalbo, Baños, and Novack (2004) study to substantiate their claim that the Cog-Log has the ability to predict performance on outpatient neuropsychological tests of attention, executive functioning, and visuospatial abilities.

**Participants and Methods:** Archival data from 68 subjects who received inpatient and outpatient care at a medium sized, Midwestern rehabilitation hospital were examined. Selected neuropsychological tests in five domains (memory, processing speed, executive functioning, attention and visuospatial abilities) were standardized ( $M = 100$ ,  $SD = 15$ ), and scores within each domain were averaged to generate linear composites. Predictors of neuropsychological performance were examined in separate hierarchical linear regression analyses. Basic demographics were accounted for within each model.

**Results:** Scores on the Cog-Log correlated significantly with cognitive measures administered, on average, 93 days post-discharge. Results indicated that the lowest Cog-Log scores predict performance above and beyond demographics on measures of memory ( $p = .006$ ,  $\beta = .399$ ,  $\Delta R^2 = .144$ ), processing speed ( $p = .041$ ,  $\beta = .272$ ,  $\Delta R^2 = .067$ ), and executive functioning ( $p = .007$ ,  $\beta = .389$ ,  $\Delta R^2 = .135$ ).

**Conclusions:** The Cog-Log appears to have utility as a predictor of neuropsychological outcome above and beyond basic demographics, particularly when used to assess outpatient memory, processing speed and executive functioning. Discrepancies between the current study and the Lee et al. (2004) study are discussed.

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#### **A. CAPPS, J.D. GFELLER, C.M. BRABEC, M.V. OLIVERI & M.J. ROSS. Detecting Insufficient Effort on Computer-Based Concussion Assessment Programs: A Comparison of Two Batteries.**

**Objective:** Assessing the neuropsychological effects of concussion with computerized testing has increased in recent years as these batteries offer significant advantages over traditional neuropsychological tests. Factors such as fatigue or low motivation, however, can influence an individual's test performance, resulting in insufficient effort. The present study examined this issue by assessing the accuracy of the Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT) and the Automated Neuropsychological Assessment Metrics Sports Medicine Battery (ASMB) to detect insufficient effort using an analog coached simulator paradigm.

**Participants and Methods:** Seventy one undergraduate participants were randomly assigned to one of three conditions (optimal performance, simulated fatigue, or simulated concussion), provided with information on how to perform, and completed ImPACT and ASMB. The sample was 70% female, 76% Caucasian, with a mean age of 19.87 ( $SD = 1.11$ ), and 13.22 ( $SD = 0.97$ ) years of education.

**Results:** Analyses indicated that the three conditions differed significantly from each other on most ImPACT composite scores and ASMB throughput scores. The simulated concussion group performed least well while the optimal performance group performed best. The performance of the simulated fatigue group typically fell between the other two groups. Classification of the optimal performance and simulated concussion groups, using ImPACT effort indicators, yielded an 87% classification rate (96% sensitivity, 78% specificity). A proposed ASMB effort indicator resulted in 79% correct classification (92% sensitivity, 65% specificity).

**Conclusions:** Both test batteries detected insufficient effort relatively well. However, replication of the findings and additional research with clinical groups is recommended.

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#### **D.L. COALSON & S.E. RAIFORD. Clinical and Psychometric Properties of the New WAIS-IV Figure Weights Subtest.**

**Objective:** The Wechsler Adult Intelligence Scale-4th edition (Wechsler, 2008) includes a new perceptual reasoning subtest, Figure Weights (FW) developed to assess quantitative and analogical reasoning.

**Participants and Methods:** The examinee views a scale(s) with missing weight(s), and selects the response that balances the scale. Participants were 1800 normative sample adults. Clinical studies included Intellectual Disability Mild ( $n=73$ ) and Moderate ( $n=31$ ), Borderline Intellectual Functioning ( $n=27$ ), Reading ( $n=34$ ) and Mathematics ( $n=41$ ) Disorders, ADHD ( $n=44$ ), TBI ( $n=22$ ), Autistic ( $n=16$ ) and Asperger's ( $n=40$ ) Disorders, Depression ( $n=33$ ), and MCI ( $n=14$ ). Concurrent validity studies were WIAT-II ( $n=93$ ), D-KEFS ( $n=52$ ), CVLT-II ( $n=234$ ), and RBANS ( $n=54$ ).

**Results:** Internal consistency was .90 overall (.88-.92) whereas retest reliability was .77. FW correlated .57 with Matrix Reasoning and .61

with Arithmetic, FW correlated .63 with WIAT-II Numerical Operations and .68 with WIAT-II Math Reasoning. FW correlated more highly with the D-KEFS Verbal Fluency Category Switching scores than any other WAIS-IV subtest or composite, and demonstrated highest correlations of all WAIS-IV subtests with CVLT-II scores. Clinical studies found moderate to large effect sizes in the Intellectually Gifted (-.83), Intellectual Disability Mild Severity (2.76) and Moderate Severity (2.84), Borderline Intellectual Functioning (1.49), Reading Disorder (.58), Mathematics Disorder (.93), TBI (.92), Autistic Disorder (1.02) groups.

**Conclusions:** Figure Weights has good reliability and correlates highly with other measures of quantitative reasoning, and with mathematics achievement measures. It is clinically sensitive, yielding large effects for Intellectual Disability, Mathematics Disorder, TBI, and Autistic Disorder. Correspondence: *Susan E. Raiford, PhD, Pearson, 19500 Bulverde Road, San Antonio, TX 78259. E-mail: susan.raiford@pearson.com*

**D.L. COALSON & S.E. RAIFORD. Clinical and Psychometric Properties of the New WAIS-IV Visual Puzzles Subtest.**

**Objective:** The Wechsler Adult Intelligence Scale-4th edition (Wechsler, 2008) includes a new perceptual reasoning subtest, Visual Puzzles (VP), developed to assess nonverbal reasoning and analysis and synthesis of abstract visual stimuli.

**Participants and Methods:** The examinee views a completed puzzle and selects three response options that reconstruct the puzzle. Participants were 2200 adults from the normative sample. Special groups included Gifted (n=34), Intellectual Disability Mild (n=73) and Moderate (n=31), Borderline Intellectual Functioning (n=27), Reading (n=34) and Mathematics (n=41) Disorders, ADHD (n=44), TBI (n=22), Autistic (n=16) and Asperger's (n=40) Disorders, Depression (n=33), MCI (n=14), and Probable Alzheimer's dementia (n=43). Concurrent validity studies were conducted with WIAT-II (n=93), D-KEFS (n=52), CVLT-II (n=234), and RBANS (n=54).

**Results:** Internal consistency reliability was .89 overall (.78-.92) whereas retest reliability was .74. VP correlated .64 with WAIS-IV Block Design, .53 with WAIS-IV Matrix Reasoning, and .48 with WAIS-IV Picture Completion; and .51 with the RBANS Visuospatial/Constructional Index. Clinical studies found moderate to large effect sizes for VP in the Intellectually Gifted (-1.15), Intellectual Disability Mild Severity (2.24) and Moderate Severity (2.66), Borderline Intellectual Functioning (1.41), Mathematics Disorder (.69), TBI (.91), Autistic Disorder (.70), and Alzheimer's dementia (1.07) groups.

**Conclusions:** Visual Puzzles has good reliability and correlates highly with other measures of nonverbal reasoning and visual perception. It is clinically sensitive, yielding large effects in examinees with Intellectual Disability, Borderline Intellectual Functioning, TBI, Autistic Disorder, and Alzheimer's dementia.

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**M. CULLUM, M. GROSCH, L. HYNAN, U. LATIF, G. TRAPP, A. GUYNN & M. WEINER. Telecognitive Assessment: Videoconferencing-based Neuropsychological Testing.**

**Objective:** Telemedicine or videoconferencing (VC) technology has advanced significantly in recent years and has proven to be an effective medium for providing psychiatric services to rural and otherwise underserved populations, but its application to neurocognitive testing has been limited. Preliminary studies suggest that close-range VC-based (telecognitive) and traditional face-to-face assessment with common tests results in similar scores in elderly subjects with and without dementia (Cullum et al., 2007). Nevertheless, telecognitive testing is in its infancy and merits further exploration in different populations.

**Participants and Methods:** A brief battery of well-known neuropsychological tests (Hopkins Verbal Learning Test, Digit Span, Letter and Category Fluency, 15-item Boston Naming Test, Clock Drawing Test, & MMSE) was administered to ten nondemented geropsychiatry outpatients over the age of 65 both in-person and us-

ing VC technology at a VA Medical Center 10 miles away. The final sample who completed all measures (7 males, 1 female) had diagnoses of major depression (n=7) and schizophrenia (n=1). The mean age was 74.6 years (range = 67-85), mean education was 13.3 years (range = 10-16), and the mean MMSE was 28 (range = 25-29). The same measures were administered in each test condition using counterbalanced alternate forms where possible, and intraclass correlations were calculated.

**Results:** Highly similar mean scores were obtained between the two testing conditions across all measures. Intraclass correlations ranged from 0.71 to 0.81, reflecting strong and significant associations (i.e., all > .60) between the different administration paradigms. Additionally, the Bradley-Blackwood Procedure was nonsignificant, indicating that the means and variances for all 10 test scores examined were similar.

**Conclusions:** These results lend further support for the use of telecognitive assessment as a valid and effective means of long-distance neuropsychological testing.

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**P. DEAN & D.A. MORERE. Validity of the Mattis Dementia Rating Scale with Culturally Older Deaf Adults.**

**Objective:** Average literacy of deaf adults is about the fourth grade level. Previous research has indicated that minority populations with lower literacy rates tend to obtain lower overall scores on the DRS. The current study investigated the validity of the DRS-2 when used with the older deaf adults.

**Participants and Methods:** Fifty-four older deaf adults (M = 67.83 years of age) whose primary communication was American Sign Language (ASL) were recruited from the DC metro area and deaf seniors conferences in Florida and Connecticut. Participants completed a demographic questionnaire and then the PIAT-R Reading Comprehension subtest, DRS-2 and MMSE were administered.

**Results:** Average age and education scores were in the Moderately Impaired range with subscales ranging from Below Average to Mildly Impaired despite atypically high levels of education for this population. Chronbachs Alpha indicated an overall weak level of internal consistency with 2 subscales having moderate to strong levels of consistency. A Standard Multiple Regression indicated that level of education and reading comprehension were significant predictors of test performance. There was a significant difference between individuals with 0-12 years of education and 13-20 years.

**Conclusions:** Linguistic and educational factors can have an impact on successful completion of test items, which ultimately impact total score. If reading comprehension is related to overall test performance, then the rate of false positive diagnoses may increase in this population. As this sample was relatively well educated, significant clinical concerns are raised for use with typical deaf senior citizens.

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**J.E. DEJONG & J. DONDERS. A Confirmatory Factor Analysis of the California Verbal Learning Test—Second Edition (CVLT-II) in a Traumatic Brain Injury Sample.**

**Objective:** The goal of the present study was to determine the latent structure of the California Verbal Learning Test—Second Edition (CVLT-II) in a sample of 223 individuals with traumatic brain injury (TBI).

**Participants and Methods:** Participants for the current study were selected from a seven-year series of consecutive rehabilitation referrals. Those with any prior (e.g., psychiatric) or comorbid (e.g., financial compensation-seeking) complicating factors were excluded. The sample was 58% male and 90% Caucasian, with an average level of education of 13 years. 24% of the participants had coma > 1 day, and 43% had acute

intracranial findings on neuroimaging. They were evaluated at an average of 116 days post-injury, at a mean age of 36 years. Analyses incorporated the z scores from 12 CVLT-II variables. Maximum-likelihood confirmatory analyses were performed to test the fit and parsimony of four hypothetical models.

**Results:** A four-factor model, consisting of Attention Span, Learning Efficiency, Delayed Recall, and Inaccurate Memory, met all of the a priori specified criteria for model fit and parsimony ( $\chi^2/df$  ratio = 1.86, Comparative Fit Index = 0.98, Parsimonious Normed Fit Index = 0.66, Root Mean Squared Error of Approximation = 0.06, and Tucker-Lewis Index = 0.97). This model was consistent with a four-factor model identified recently in the standardization sample.

**Conclusions:** The results support the construct validity of the CVLT-II in individuals with TBI, and indicate that a multi-factorial interpretation of the instrument is appropriate for clinical practice.

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#### M. DICKINSON & M. HISCOCK. The Flynn Effect in Neuropsychological Assessment: What a Difference a Decade Can Make.

**Objective:** The Flynn effect describes the dramatic rise in IQ since the implementation of intelligence testing. The magnitude of the effect depends on the test (e.g., “fluid” abilities have increased more rapidly than “crystallized” abilities). Previous research indicates that neuropsychological tests such as the Trail Making Test (TMT) and Symbol Digit Modalities Test (SDMT) are susceptible to the Flynn effect, but other tests are not. The current study examined the pattern and magnitude of the Flynn effect on selected neuropsychological tests and compared the findings to those reported in studies of IQ tests.

**Participants and Methods:** Five neuropsychological tests with norms published in different decades were selected for analysis of the magnitude of change in performance over time as well as the shape of the curve (linear versus quadratic). Norms published at various times were used to determine the significance of the changes. Analyses of covariance (ANCOVA) were used to adjust for any age differences among normative samples.

**Results:** ANCOVA and trend analysis revealed a linear decline ( $p < .005$ ) in TMT completion time for both Parts A and B over a span of 36 years. Performance for the oral but not written administrations of the SDMT improved over an interval of 12 years ( $p < .005$ ). The magnitude of these increases in TMT and SDMT performance was equivalent to 6 IQ points per decade. In contrast, no significant linear changes were found for the Boston Naming Test, Finger Tapping, or the Grooved Pegboard Test.

**Conclusions:** The Flynn effect, when present in neuropsychological test data, manifests itself in a pattern and magnitude of change that is similar to the pattern and magnitude observed in IQ testing. Specifically, the Flynn effect in both realms appears to be a largely linear trend of improving performance across generations. The strength of the Flynn effect on the SDMT and TMT (6 IQ points per decade) is comparable to the strongest effects found in intelligence testing.

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#### J.N. DODD & N.A. DEFILIPPIS. Sensitivity and Specificity of the Neurobehavioral Status Examination for a HIV+ population.

**Objective:** The Neurobehavioral Status Examination (NSE) is a condensed version of Alexander Luria’s original neurological examination covering all areas of his examination in a 44-item screening interview. Several authors have established validity for the NSE, but there have been no studies on sensitivity or specificity of the instrument. The current study aimed to establish further validity to the NSE with an HIV+ population, many of whom suffer from HIV-related mild cognitive impairment (MCI).

**Participants and Methods:** Twenty-three HIV+ subjects were administered a neuropsychological screening battery and the NSE. The sub-

jects had a mean age of 42.43(6.9) and mean education of 13.83 (2.3). Subjects were classified as “MCI” or “Normal.” NSE scores were classified as “NSE Impaired” or “NSE Normal.” Chi-square analysis was conducted to compare groups. Spearman’s correlations were conducted between “MCI” and NSE “Impaired” status. Sensitivity and specificity were calculated for NSE cutoff scores of 75 and 78.

**Results:** The NSE cutoff score of 75 showed a strong association with MCI ( $P_s = .657$ ;  $p < .01$ ). Chi-square analysis yielded significant results as well ( $\chi^2 = (1, N = 23) = 7.348$ ,  $p < .01$ ). Sensitivity was weak (0.56), but specificity was excellent (1.0). The NSE cutoff score of 78 yielded optimal sensitivity and specificity scores of 0.88 and 0.86, as well as stronger correlations with MCI ( $P_s = .734$ ;  $p < .01$ ). However, Chi-square was not statistically significant,  $\chi^2 = (1, N = 23) = 0.391$ ,  $p > .05$ .

**Conclusions:** The current study adds clinically useful information regarding the optimal cutoff score for this instrument.

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#### R. GAVETT, B. BOROSH, J. DEOCAMPO, S. DIKMEN, J. SLOTKIN, D. MUNGAS, B. HEATON, S. WEINTRAUB & P. BAUER. The IBAM Shows Strong Convergent Validity with the RAVLT in Older Adults.

**Objective:** Bauer’s Imitation Based Assessment of Memory (IBAM) is a new measure aimed at addressing the lack of a well-accepted standard of episodic memory measure in young children. This measure is being developed as part of the NIH Toolbox to assess memory in ages ranging from 3 to 85 year olds. With this test, sequences of related or unrelated pictures of objects or actions are presented in a particular order. Recall of temporal information is tested by instructing subjects to reproduce the demonstrated order. This new measure was investigated in older adults with normal cognition and cross validated with the Rey Auditory Verbal Learning Test (RAVLT).

**Participants and Methods:** Twenty-nine participants age 65 and older were administered either the single (1 exposure) or repeated condition (three repetition) of the IBAM and three trials of RAVLT. Three different forms of the IBAM were used. For the single exposure condition, participants were shown the sequence of pictures once and had immediate and delayed recall trials. For the repeated condition, each sequence of pictures was presented to the participant three times with three recall trials but there was no delayed recall trial.

**Results:** Three scoring procedures have been suggested for the IBAM, examining total pairs (TP), adjacent pairs (AP), and exact location of pictures (EL). In the repeated condition, we examined the relationship between the third trial of the IBAM and the third trial of the RAVLT. There was a strong positive correlation between RAVLT and TP (.702), AP (.737), and EL (.826) ( $p < .01$ ). In the single condition, we examined the relationship between the delay trial of the RAVLT and delay trial of the IBAM. TP (.691) and AP (.639) were positively correlated ( $p < .01$  and  $p < .05$ , respectively). However, EL was not.

**Conclusions:** The IBAM shows strong convergent validity with several of the measures derived from the RAVLT and may provide a convenient, nonverbal and ecologically relevant method for testing memory throughout the life span.

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#### M.F. GONZÁLEZ, C. BUIZA, E. ARRIOLA, C. HERNANDEZ, M. FERNANDINO & J. YANGUAS. Assessment of the Cognitive Over-All Functioning in Patients with Severe Dementia: Validation the SMMSE into Spanish Population.

**Objective:** Severe cognitive impairment is an entity not widely studied yet. Whereas a lot of assessment tools have been developed for mild stages of dementia, the same had not happened in late stages. Besides, most of these scales have not been validated in Spanish population. The SMMSE scale was designed to briefly assess cognitive domains relatively preserved in moderate to severe dementia. The objective of this study was to validate the SMMSE scale into the Spanish population.

**Participants and Methods:** Firstly, the SMMSE was translated from English to Spanish. After that, 68 patients diagnosed with severe dementia were assessed with both MEC (a Spanish validation of MMSE, Lobo et al, 1999) and SMMSE scales at the same time. The sample was composed by 10 male and 58 female with a mean age of 84.74 years old (sd = 7.15). It was established that patients with severe dementia were those that scored 5 or more in Reisberg's Global Deterioration Scale.

**Results:** The reliability (internal consistency) of the SMMSE was very high (Cronbach's alpha = 0.918). A Pearson Correlation was also calculated in order to know the relation between the total score in MEC and SMMSE. A significant and high correlation ( $r = .881$ ,  $p < .01$ ) was found, meaning high validity of the scale.

**Conclusions:** The SMMSE has good psychometric properties, and therefore is a good tool for assessing the overall cognitive impairment in Spanish population with severe dementia. This scale is especially useful when patients with severe dementia are not able to be assessed by MMSE due to "floor effect".

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**L.H. HEFLIN, J. JANG, R. KETELLE, V. LALUZ, B.L. MILLER & J.H. KRAMER. Let's Inhibit Our Excitement: Slow Stroop Performance Indicates Neither Disinhibition nor Frontal Lobe Atrophy.**

**Objective:** The Stroop is among the most frequently used neuropsychological tests, and poor performance is typically interpreted as indicative of disinhibition and frontal lobe damage. This study examines how well the Stroop reflects behavioral disinhibition and frontal lobe atrophy.

**Participants and Methods:** Two hundred well-characterized participants with dementia or mild cognitive impairment (MCI) were used to examine the relationship between Stroop performance and behavioral disinhibition. The D-KEFS Color-Word Interference Test was the Stroop task used, and disinhibition was measured using the Disinhibition scale of the Neuropsychiatric Inventory. The association between frontal atrophy and Stroop Interference was examined with a subset of 131 participants with imaging data. Freesurfer, a semi-automated parcellation program, was used to analyze 1.5T structural MRI scans.

**Results:** The sample mean age was 67.21 (SD=9.71) years, education was 16.39 (SD=2.54) years, and MMSE was 26.65 (SD=3.65). Controlling for age, MMSE, and Color Naming speed in hierarchical linear regression, slower D-KEFS Color-Word Interference performance predicted less behavioral disinhibition ( $\beta = -0.65$ ,  $\Delta R^2 = .02$ ,  $p = .04$ ). Separate hierarchical regressions examined whether left hemisphere, right hemisphere, or total frontal lobe regions predict Interference speed, with a Bonferroni-adjusted  $p$ -value of .016. Controlling for age, MMSE, Color Naming speed, temporal lobe, parietal lobe, and total intracranial volume, none of the frontal regions (orbitofrontal, rostral and caudal middle frontal gyrus, inferior frontal gyrus, superior frontal gyrus) or the anterior cingulate were significant predictors of Interference speed ( $p > .02$ ).

**Conclusions:** These findings suggest the Stroop is a poor measure of real-world disinhibition and frontal lobe atrophy even among a relatively high-risk population.

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**R.S. HILBORN, D. BUMFORD, M.F. WEINER, C.M. CULLUM & L.H. LACRITZ. Construct Validity of the Montreal Cognitive Assessment (MoCA) in a Mixed Diagnostic Sample.**

**Objective:** The Montreal Cognitive Assessment (MoCA) is a brief cognitive screening measure designed to assist in the detection of Mild Cognitive Impairment (MCI). This study explored the validity of the MoCA by comparing it to the Dementia Rating Scale-2 (DRS-2) and California Verbal Learning Test-II (CVLT-II).

**Participants and Methods:** 34 consecutive subjects (M age=71.2, M education=13.8), were administered the MoCA, DRS-2, and CVLT-II as part of clinical evaluation for possible dementia. Pearson's correlations were conducted across selected variables.

**Results:** MoCA scores (M=20.4) were significantly related to the DRS-2 (M=127.7;  $r = .72$ ) and CVLT-II total scores (M T score=32.3;  $r = .61$ ). 94% of subjects scored below the published cutoff for the MoCA ( $< 26$ ), compared to 63% for the DRS-2 ( $\leq 130$ ) and 65% for CVLT-II (T-score  $< 40$ ). Of the DRS-2 subtests, MoCA scores were correlated most highly with Memory ( $r = .70$ ), with more modest associations with Construction ( $r = .43$ ) and Initiation/Perseveration ( $r = .34$ ). Interestingly, 83% of individuals scoring in the normal range on the CVLT-II, and 85% on the DRS-2, scored below the cutoff on the MoCA. Review of MoCA memory items revealed that  $> 50\%$  of the sample recalled 0/5 words after a brief delay, including 4 subjects with normal CVLT-II delayed recall scores.

**Conclusions:** Results support the validity of the MoCA as a screening tool in neurodegenerative populations, though the published cut-score may overidentify "impairment." Furthermore, the memory items may be problematic thereby supporting the need for cautious interpretation and further validation in various populations.

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**M. HISCOCK, N. MEDINA & D. SMITH. A Direct Comparison of Three Methods for Detecting Feigned Impairment.**

**Objective:** The pseudo-perceptual test (PPT) is a malingering-detection task on which the examinee tries to distinguish between two confusable stimuli, after which he or she receives a "correct" or "incorrect" signal. In actuality the task is impossible and the feedback is contrived. Honestly performing participants make choices to maximize positive reinforcement whereas participants who are instructed to do poorly tend to earn positive reinforcement on only 50% of trials. We used an analogue design to evaluate the efficacy of the PPT in comparison with a two-alternative forced-choice test (FCT) and a rarely missed index (RMI) test.

**Participants and Methods:** Eighty-four university students (42 females and 42 males) were assigned randomly to three conditions: honest performance; coached faking; uncoached faking. Participants in the faking conditions read a hypothetical scenario in which their involvement in a collision provided incentive to feign an acquired disability. Participants completed the three malingering tests (PPT, FCT, and RMI) in counterbalanced orders.

**Results:** Multivariate analysis of variance (MANOVA) indicated that all three malingering-detection tests differentiated the groups ( $p < .0001$ ), but not equally well ( $p < .0001$ ). Subsequent analyses showed that PPT distinguished the groups better than the RMI but not as well as the FCT. Decision theory analyses, using optimal cutoffs, yielded overall classification accuracy of 94% for the FCT, 89% for the PPT, and 83% for the RMI.

**Conclusions:** Although the analogue method might not provide an accurate estimate of a malingering test's actual efficacy in a particular clinical setting, it does offer an opportunity to compare different tests under controlled conditions. In this instance, the comparison indicates that the PPT, a novel and unproven malingering-detection task, is nearly as effective as one well-established malingering test and slightly more effective than another test.

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**M. HISCOCK, S. RANE, N. LACHNER, M. PAPAIOANNOU & J. CAROSELLI. A Paper Version of the Non-Manual Trail Making Test.**

**Objective:** A computerized non-manual Trail Making Test (NMTMT) has been developed for use with manually impaired patients. Test stimuli are colored to allow oral responses: "one, yellow;" "two, green," etc.

Previous work indicates that the NMTMT has satisfactory construct validity and that scores are moderately correlated with scores from the standard Trail Making Test (TMT). To make the NMTMT more convenient to use, we have created a paper version (NMTMT-P). The current study compares the NMTMT-P with both the computerized NMTMT and the conventional TMT.

**Participants and Methods:** Eighty university students (50 females, 30 males) participated in the study. Participants completed the TMT, NMTMT, and NMTMT-P in counterbalanced orders. Because the computer draws the connecting lines for the examinee during NMTMT administration, the NMTMT-P was administered twice, once with and once without lines drawn by the examiner.

**Results:** Performance differed significantly across the four versions,  $p < .0001$ . The NMTMT-P required nearly 24 s more time than the TMT but 4.5 s less than the computerized NMTMT. The NMTMT-P without lines required 9 s longer than the same test with lines,  $p < .001$ . There was no significant gender difference. Correlations between corresponding NMTMT-P and NMTMT scores ranged from .36 to .45, and correlations between NMTMT-P and TMT scores ranged from .26 to .53. The correlation between Parts A and B of the NMTMT-P was .53 when lines were drawn by the experimenter and .59 when lines were not available.

**Conclusions:** Converting the non-manual TMT from a computer-administered format to a paper format had little effect on performance. Scores obtained from the paper test were moderately correlated with scores from both the original TMT and the computerized non-manual TMT. Having to perform the non-manual test without leaving a trail of lines increased completion time by 9 s. These preliminary data support the feasibility of a non-manual TMT in which stimuli are presented on paper in lieu of a computer screen. Correspondence: *Merrill Hiscock, Ph.D., Psychology, University of Houston, Heyne Bldg, Room 126, Houston, TX 77204-5022. E-mail: mhiscock@uh.edu*

**P.A. HOGGARTH, C.R. INNES, J.C. DALRYMPLE-ALFORD & R.D. JONES. A Nonlinear Model of Cognitive and Sensory-Motor Test Performance Can Aid in Prediction of On-Road Driving Ability in Older Adults.**

**Objective:** Drivers aged 70 and over are a rapidly growing segment of the population that includes proportionately more medically and/or cognitively impaired individuals. Off-road screening and assessment can play an important role in catering for this burgeoning number of potentially impaired drivers.

**Participants and Methods:** Sixty healthy drivers aged 70 and above (mean 76.7, range 70-84) were assessed with a battery of computerized sensory-motor and cognitive tests presented as part of a face-valid driving assessment system (the Canterbury Driving Assessment Tool - CanDAT) and a set of standard cognitive tests. Each participant also completed a blinded on-road driving assessment conducted by a driving occupational therapist and a driving instructor. Binary logistic regression (BLR) and non-linear causal resource analysis (NCRA) were used to build classification models of driving assessment outcome.

**Results:** Sixteen participants (27%) failed the on-road assessment. Two tests were predictors in the BLR model (Trail Making Test B and a computerized visuomotor tracking task) to correctly classify 77% of participants as on-road pass/fail (Area under ROC [AUCROC] = .76). NCRA correctly classified 87% (AUCROC = .88). Sensitivity for classifying on-road fails was superior using NCRA (75% compared to 25% for BLR).

**Conclusions:** Results indicate that focusing on intra-individual variation in performance across a variety of resource-dependent tasks – as is NCRA's explicit function – may be a useful alternative to standard regression methods to estimate complex real-world tasks such as driving. A 2-year prospective follow-up of driving accidents, citations, and driving behaviour is underway to identify further factors to improve the predictive accuracy of driver safety.

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**J. HOLDNACK & L. DROZDICK. Clinical and Psychometric Properties of the New WMS-IV Visual Working Memory Subtests.**

**Objective:** The assessment of working memory in the Wechsler Memory Scale-4th edition (Wechsler, 2009) includes new measures of visual working memory, Spatial Addition (SA) and Symbol Span (SY), replacing Spatial Span and Letter-Number Sequencing subtests from the WMS-III.

**Participants and Methods:** The SA subtest requires examinees to hold and manipulate spatial locations in working memory. On SY, the examinee remembers the sequence of a series of visual designs of increasing number. Participants were 1,400 healthy adults from the WMS-IV standardization sample. Clinical samples included Math Disorder ( $n=22$ ), Traumatic Brain Injury ( $n=30$ ), Right Temporal Lobectomy ( $n=15$ ) and Schizophrenia ( $n=55$ ). Concurrent validity studies were WAIS-IV ( $n=1400$ ), WMS-III ( $n=210$ ), WIAT-II ( $n=54$ ), and ABAS-II ( $n=29$ ).

**Results:** The internal consistencies ranged from .89-.92 for SA and .76-.92 for SY. SA and SY correlated with Spatial Span .55 and .52, Digit Span .46 and .47, and Arithmetic .51 and .45, respectively. They correlated significantly with Math Reasoning (.61-.67) and Numerical Operations (.52-.67). Clinical studies found large effect sizes for SA in the TBI ( $d=1.23$ ), RTLE ( $d=1.00$ ), and Math Disorder ( $d=.80$ ) groups. SY showed large effects in Schizophrenia ( $d=1.01$ ). In TBI patients, performance on SA related to daily functioning skills including Community Use ( $r=.53$ ) and Social Functioning ( $r=.52$ ).

**Conclusions:** The new WMS-IV visual working memory subtests, Spatial Addition and Symbol Span have good reliability and concurrent validity. The subtests are clinically sensitive yielding large effect sizes in patients with known brain injury. The tests relate to academic and daily living skills indicating ecological validity.

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**J. HOLDNACK & L. DROZDICK. Clinical and Psychometric Properties of the new WMS-IV Design Memory Subtest.**

**Objective:** The Wechsler Memory Scale-4th edition (Wechsler, 2009) includes a new measure of visual-spatial memory, Designs (DE), replacing the Family Pictures subtest from the WMS-III.

**Participants and Methods:** The DE subtest requires examinees to remember the locations of different designs on a 4 X 4 grid. There are immediate and delayed recall trials. Participants were 900 healthy adults from the WMS-IV standardization sample. Clinical samples included Math Disorder ( $n=22$ ), Traumatic Brain Injury ( $n=30$ ), Right Temporal Lobectomy ( $n=15$ ), and Autism ( $n=55$ ). Concurrent validity studies were WMS-III ( $n=210$ ), RBANS ( $n=100$ ), and ABAS-II ( $n=29$ ).

**Results:** Results: The internal consistencies ranged from .80-.90 for Immediate and .80-.89 for Delayed Recall. DE immediate and delayed recall correlated .38-.47 with WMS-IV Visual Reproduction, .41-.43 WMS-III Family Pictures, and .35-.38 WMS-III Faces and .38-.44 with RBANS memory scores. Clinical studies found significant moderate to large effect sizes for DE immediate and delayed recall in the TBI ( $d=1.20$  and .90), RTLE ( $d=1.66$  and .96), Math Disorder ( $d=1.06$  and .78) and Autism ( $d=1.45$  and 1.38) groups. In TBI patients, performance on DE delayed content memory related to daily functioning skills including Functional Academics ( $r=.62$ ), Community Use ( $r=.65$ ), Health and Safety ( $r=.63$ ), and Self-Care ( $r=.57$ ).

**Conclusions:** The WMS-IV Designs memory subtest has good reliability and correlates moderately with other visual memory measures. The Designs immediate and delayed scores are clinically sensitive yielding large effect sizes in patients with known brain injury. The delayed content score correlates with daily living skills in patients with TBI indicating ecological validity.

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**M. HOLLIMON, J. LINCK, J.G. SCOTT & R.L. ADAMS. Validity of the Memory Subtests of the Repeatable Battery of Neuropsychological Status in a Mixed Population Referred for Neuropsychological Testing.**

**Objective:** When first developed the convergent validity of the RBANS index and total scores were found to significantly correlate with various other comparable measures of cognitive functioning. The purpose of the current study was to examine the convergent validity of the RBANS memory subtests among a mixed diagnostic sample. The first hypothesis was that the RBANS memory subtests would significantly correlate with other comparable but more difficult memory measures. The second was that the RBANS Immediate and Delayed Memory indices would significantly correlate with the other memory measures.

**Participants and Methods:** The participants of the current study included 300 patients who had been referred for neuropsychological testing to an outpatient neuropsychological service associated with a major university hospital. The participants included 139 males and 161 females who had a variety of neurological diagnoses. To evaluate the convergent validity of the RBANS memory subtests each subtest was correlated with comparable neuropsychological measures that included the WMS-R Logical Memory subtests, Rey Auditory Verbal Learning Test (RAVLT), and the Rey Complex Figure Test (RCFT). The RBANS Immediate Memory and Delayed Memory indices were then correlated with the comparable neuropsychological measures.

**Results:** The RBANS memory subtests significantly correlated with their comparable measures. Correlations ranged from .362 with the RBANS List Recognition and RAVLT Recognition subtests to .745 with the RBANS List Learning and the RAVLT Total. All of the RBANS memory subtests and the comparable measures significantly correlated with the RBANS Immediate Memory Index and the Delayed Memory Index.

**Conclusions:** The results of this study supported the RBANS memory subtests as being valid screening tools of immediate and delayed memory when compared with other comparable measures of memory commonly used in neuropsychological evaluations.

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**M.D. HORNER, K. KNELE & T.L. MCFALL. Relationship Between Self-Reported Neurobehavioral Symptoms and Effort Test Performance in Veterans Screened for TBI.**

**Objective:** To examine whether higher scores on the self-report Neurobehavioral Symptom Inventory (NSI) would be associated with increased likelihood of failing effort tests on subsequent neuropsychological examination.

**Participants and Methods:** The NSI is a 22-item self-report questionnaire of somatic, cognitive, and psychological complaints that is administered to all VA patients who screen positive for possible TBI in Operation Iraqi Freedom/Operation Enduring Freedom. We examined data from 40 such consecutive veterans who were subsequently seen for clinical neuropsychological evaluation. Effort indices included Test of Memory Malingering (TOMM), Rey 15-Item Test with Recognition Trial (RFIT-RT), and Reliable Digit Span (RDS). Patients were considered to demonstrate low effort if TOMM Trial 2 or Retention < 45, or RFIT-RT (recall+hits-false positives) < 20, or RDS < 7. Examiners were blind to NSI scores at time of evaluation.

**Results:** Patients with low effort (N=11) did not differ from those with adequate effort (N=29) on age or education. The groups did not differ on NSI total score or subscores. Distributions of NSI scores were similar between groups; no NSI cut score discriminated low vs. adequate effort. However, there were significant, negative correlations between NSI scores and nearly all effort test scores, including TOMM Trials 1 and 2, RFIT-RT recall, RFIT-RT total, and RDS.

**Conclusions:** The NSI could not be used effectively to predict which patients would fail effort tests on neuropsychological examination. However, greater self-report of neurobehavioral complaints was associated with poorer performance on effort tests, simple tasks that even impaired patients can perform without difficulty.

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**J. HUMPHREYS CLARK, V.L. HOBSON & S.E. O'BRYANT. Diagnostic Accuracy of Percent Retention Scores on RBANS Memory Subtests for the Identification of Alzheimer's Disease and Mild Cognitive Impairment.**

**Objective:** The purpose of the current study was to examine the diagnostic accuracy of percent retention scores on memory subtests of the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) in detecting AD and aMCI.

**Participants and Methods:** Data from 171 individuals evaluated through a memory disorders clinic were examined. The sample's mean age and education were 75.7 (SD = 7.0) and 13.15 (SD = 3.4), respectively. The sample consisted of 20 (11.7%) normal controls, 95 (55.6%) patients with a diagnosis of Alzheimer's Disease (AD), and 56 (32.7%) patients diagnosed with amnesic Mild Cognitive Impairment (aMCI). Using scores on the RBANS memory subtests, three retention scores were computed: List Retention, Story Retention, and Figure Retention. Sensitivity (SN) and specificity (SP) of the three retention scores in distinguishing between normal controls, AD, and aMCI was examined.

**Results:** When discriminating between normal controls and AD, diagnostic accuracy was maximized at a score of 50% (SN=0.91, SP=1.00) or less on List Retention, 70% (SN=0.94, SP=0.96) or less on Story Retention, and 30% (SN=0.87, SP=1.00) or less on Figure Retention. These scores successfully classified 91.0%-94.9% of subjects. When distinguishing between normal controls and aMCI, a score of 70% (SN=0.89, SP=0.75) or less on List Retention, 80% (SN=0.81, SP=0.83) or less on Story Retention, and 60% (SN=0.85, SP=0.67) or less on Figure Retention led to correct classification of 79.2%-84.4% of subjects.

**Conclusions:** These results support the utility of the calculated RBANS memory retention scores for the detection of AD or MCI.

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**M. INGRAM, A.A. BRODSKY, A. JONES, L. WILLIAMS & H. OAKES. A Direct Comparison of the Green Word Memory Test and the Validity Indicator Profile.**

**Objective:** The assessment of effort in neuropsychological testing is integral to obtaining reliable and useful data regarding patient functioning, with research suggesting that up to 50% of the variance in a neuropsychological assessment may be explained by effort/motivation, rather than any specific neurological insult or injury (Rohling, Green, Allen, and Lees-Haley, 2000). Multiple instruments have been generated and/or utilized by the profession of Neuropsychology to measure this construct and the utility of each instrument is gauged by its sensitivity, specificity, apparent face validity, normative basis, resistance to coaching, ease of administration, and validation studies that include normals, various patient populations, and suspected or verified individuals with poor effort. A succinct, tabular comparison of each of the more commonly used measures of effort across these variables is available in Hartmann, 2002. Although only one measure, the Green WMT, was defined as adequate across all of these defined dimensions, published head-to-head comparisons of the Green WMT with the Validity Indicator Profile (VIP) are nonexistent.

**Participants and Methods:** A retrospective analysis of 65 patient cases completing both the Green WMT and the VIP as components of a comprehensive neuropsychological assessment battery was conducted. Within subject and across subject analysis of variance was conducted.

**Results:** A marked disparity in agreement between the two tests was identified in this largely mild Traumatic Brain Injury patient population.

**Conclusions:** Hypotheses regarding the reasons for these discrepancies and the consequent utility of these assessment instruments are offered.



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#### **G.L. IVERSON, B.L. BROOKS & J.A. HOLDNACK. Low Scores Across the WAIS-III/WMS-III Vary by Education & Intelligence.**

**Objective:** Clinicians need information on the base rate of low scores in healthy adults across a battery of tests to reduce the likelihood of misdiagnosing cognitive impairment. The purpose of this study is to present comprehensive base rate tables for the frequency of low scores in healthy adults across the Wechsler Adult Intelligence Scale-Third Edition (WAIS-III) and Wechsler Memory Scale Third Edition (WMS-III).

**Participants and Methods:** Participants were 1,250 healthy adults from the WAIS-III/WMS-III standardization sample. The base rates of low scores are based on the 20 primary subtest scores from the WAIS-III and the WMS-III, which yield 12 primary index scores. Analyses are presented for the entire sample, age groups, education groups, WAIS-III full scale IQ groups, and WTAR-demographics predicted full scale IQ groups.

**Results:** When the 20 primary subtest scores were considered simultaneously, 60.8% had at least one score at or below the 9th percentile ( $SS \leq 6$ ) and 43.3% had at least one score at or below the 5th percentile ( $SS \leq 5$ ). It is common for healthy adults to have 0-3 scores at or below the 9th percentile and 0-2 scores at or below the 5th percentile. When stratified by education, the percentage of adults with one or more scores at or below the 5th percentile was as follows: 8 or fewer years=64.3%, 9-11=65.4%, 12=41.4%, 13-15=35.4%, and 16+ years=27.1%. When stratified by WTAR-Demographics predicted intelligence, the percentage of adults with one or more scores at or below the 5th percentile was as follows: borderline=88.9%, low average=76.8%, average=42.4%, high average=17.9%, and superior=6.2%.

**Conclusions:** Comprehensive base rate tables for low scores across the combined WAIS-III/WMS-III are available for the first time in this study. This study illustrates that (a) low scores are common in healthy adults, and (b) the number of low scores varies by level of education and intelligence.

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#### **K.D. KANE, B.P. YOCHIM & J.L. BORST. NAB Naming Test: Convergent and Discriminant Validity.**

**Objective:** This study explored the convergent validity of the Neuropsychological Assessment Battery (NAB) Naming subtest by exploring its relationship with the Boston Naming test (BNT), an established measure of naming abilities. Discriminant validity was explored by assessing its relations with less-related measures of processing speed and executive functioning.

**Participants and Methods:** Sixty-eight community-dwelling adults ( $M$  age = 75.46 years, range = 60-88 years, 59% Female, 96% European American) were administered the BNT, NAB Naming test Forms 1 and 2, WAIS-3 Digit Symbol, and Verbal Fluency (FAS).

**Results:** Both forms of the NAB Naming test were correlated with each other ( $r = .75, p < .01$ ) and the BNT (Form 1  $r = .69, p < .01$ ; Form 2  $r = .61, p < .01$ ). Form 1 and Form 2 were correlated with age (Form 1  $r = -.36, p < .01$ ; Form 2  $r = -.33, p < .01$ ). Education correlated with Form 1 ( $r = .36, p < .01$ ) and Form 2 ( $r = .24, p = .05$ ), whereas the BNT correlated with education more strongly,  $r = .43, p < .01$ ). Both forms of the NAB Naming test were uncorrelated with Verbal Fluency ( $r = .06, p > .05$ ; Form 2  $r = .11, p > .05$ ), and weakly correlated with Digit Symbol (Form 1  $r = .25, p < .05$ ; Form 2  $r = .20, p > .05$ ).

**Conclusions:** This study suggests that the NAB Naming test possesses both convergent and discriminant validity, as well as alternate forms reliability.

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#### **M.A. KEISKI, G.Z. RECKESS, C.C. PRICE, M.S. OKUN & D. BOWERS. Equivalence of WCST-128 and WCST-64 in Pre and Post DBS Patients with Parkinson's Disease.**

**Objective:** Executive functioning should be evaluated in patients with Parkinson's disease. However, administration of the Wisconsin Card Sorting Test (WCST) can be time-consuming and frustrating for these patients. The purpose of this study was to determine whether the abbreviated version (WCST-64) yielded similar scores to the full version in a sample of PD patients.

**Participants and Methods:** We retrospectively identified 121 WCST protocols administered to PD patients during comprehensive neuropsychological evaluations. As a group, the patients were mostly males (67%) in their mid-60s ( $M=64, SD=9.7$ ) who had been diagnosed with PD 9.5 years ( $SD=5$ ) earlier; 46 had undergone deep brain stimulation. For each protocol, scores were computed for the short and long versions of the WCST.

**Results:** Initial analyses revealed robust correlations between the two WCST versions for number of categories completed ( $r_s=.841, p=.000$ ), total errors ( $r^2=.813, p=.000$ ), and perseverative errors ( $r^2=.756, p=.000$ ), but less so for failures to maintain set ( $r_s=.542, p=.000$ ). For number of categories completed, 53% of the sample was categorized in the same percentile classification level and another 38% changed by one classification level. Across versions, T-scores for total errors and perseverative errors were discrepant by less than one standard deviation for 90% of the sample.

**Conclusions:** WCST-64 scores adequately approximated those on the WCST-128 in the majority of pre and post-DBS PD patients. The findings generally support use of the abbreviated version in this population, while providing evidence for the concurrent validity of the WCST-64.  
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#### **S. KEY-DELYRIA, L. ALTMANN & P. CARVAJAL. The Naming to Definition Task is Not Just Testing Lexical Access.**

**Objective:** The Naming to Definition (NTD) task has been used as a naming task which is assumed to differ from picture naming only in modality. This study evaluated whether the auditory NTD relies on cognitive processes other than lexical access in healthy older adults. We hypothesized that, in addition to lexical access, processing speed and executive function affect NTD, because auditory presentation unfolds over time and requires information manipulation.

**Participants and Methods:** Twenty-two healthy older adults with a mean age of 78.75 and mean MMSE of 29 were recruited from the community as part of a larger study. Participants completed a battery of measures including digit span forward, backward and ordering, word span forward, backward and alphabetization, the Shipley vocabulary measure, the Boston Naming Test (BNT), WASI similarities, and Trails A and B. Each NTD stimulus included information about category, perceptual and functional features of the object.

**Results:** Pearson correlations revealed that performance on the NTD was significantly related to WASI similarities ( $r=.476; p=.026$ ) and Trails B ( $r=-.486, p=.022$ ) in addition to the BNT ( $r=.569; p=.021$ )

**Conclusions:** As predicted, NTD correlated significantly with tasks other than lexical access (i.e., the BNT). The relationship with WASI similarities likely reflects common task demands between the tasks, namely combining concepts. Trails B is considered to be an executive functioning measure tapping processing speed and planning. Thus, performance on the NTD task could be compromised by either executive function or semantic impairments. The results emphasize the importance of verifying underlying task demands of cognitive measures even in seemingly straightforward cases.

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**J. MORRIS, B. KOPALD, L. GLASS, I. JACKSON & J.J. RYAN. Alternate Paragraphs for the Logical Memory Subtests of the Weschler Memory Scale-III.**

**Objective:** The purpose of this study was to develop an alternate form of the WMS-III Logical Memory paragraphs for use in test-retest situations. The Morris Revision-III (MR-III; Morris, 2008) consists of two paragraphs (Rick Ventura/Greg Fortune) that were designed to be equivalent in structure, number of scorable units, and psychometric characteristics to the WMS-III LM paragraphs (Anna Thompson/Joe Garcia). **Participants and Methods:** Fifty undergraduate students from a private university in the Chicago metropolitan area served as participants. They were administered the WMS-III and MR-III LM paragraphs in a counterbalanced order. Dependent samples t-tests were conducted to determine if the raw scores of the WMS-III paragraphs were equivalent to those of the MR-III.

**Results:** Displayed in Table 1 are the means, standard deviations, and Pearson correlation coefficients for the raw scores of the WMS-III and MR-III paragraphs. There was no significant difference between the WMS-III Joe Garcia and MR-III Rick Ventura paragraph mean scores,  $t(49) = -0.77, p = .45$ . Similarly, the WMS-III Anna Thompson and MR-III Greg Fortune mean scores did not significantly differ,  $t(49) = -0.87, p = .39$ . The total raw scores of the WMS-III LM paragraphs were significantly correlated with those of the MR-III paragraphs,  $p < .01$ .

**Conclusions:** The MR-III was determined to be a psychometrically equivalent alternate form of the original Logical Memory subtest, and it is recommended for use when serial testing is necessary. Future research using clinical samples is planned.

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**M. KRAYBILL, Y. SUCHY & B. ADAM. Longitudinal Prediction of Functional Independence and Cognition: The Utility of a Brief Motor Programming Task.**

**Objective:** Many efforts have been made to understand the correlates of future declines in cognition and functional independence. Age-related declines in cognitive functioning may be relatively subtle which makes it difficult to assess individuals' risk for problems with instrumental activities of daily living (IADLs). The purpose of this study was to examine the utility of a motor programming (MP) task in the prediction of IADL errors and declines in cognition one year after an initial evaluation.

**Participants and Methods:** 25 older adults (age 62 to 87) completed an initial battery of neuropsychological tests and returned for follow-up testing after one year (mean time = 1.2 years, SD=.23). Testing included a computerized MP task (i.e., the Push-Turn-Taptap task from the Behavioral Dyscontrol Scale-electronic version), the Mattis Dementia Rating Scale (DRS) as a cognitive screening measure, and the Timed Instrumental Activities of Daily Living (TIADL) task as a measure of functional independence.

**Results:** MP, and more specifically motor planning (M-PLN), was significantly correlated with the number of errors made on the TIADL task at the time of follow-up ( $r = .596, p < .01$ ). M-PLN was also correlated with the DRS at both the initial and follow-up testing sessions (Initial:  $r = -.724, p < .01$ , Follow-up:  $r = -.567, p < .01$ ). Larger increases in M-PLN latencies, due to increases in task complexity, also correlated with declines in follow-up DRS scores ( $r = .378, p < .01$ ).

**Conclusions:** MP tasks may provide a relatively brief way of assessing individuals' risk for developing declines in cognitive abilities and problems with IADLs. The advantage of using MP planning tasks is that they are less confounded by visuospatial, language, or memory abilities.

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**G. KRIGBAUM, K. AMIN, T. VIRDEN III, L. BACA & A. URIBE. A Pilot Study of the Sensitivity and Specificity Analysis of the Standard-Spanish Version of the Culture-Fair Assessment of Neuro-Cognitive Abilities (CANA) & The Mini Mental State Examination in Spanish (Examen Cognoscitivo Mini-Mental) with Population from the Dominican Republic.**

**Objective:** As the Hispanic population increases and individuals live longer, there is a critical need to develop culturally sensitive neuro-cognitive screening tools that address the cognitive deficiencies of this growing population. Because of the dearth of information, it is known that there is a great need for evidence-based neuro-assessments, culturally validated in Spanish, which would increase the sensitivity as well as specificity of the given assessment. This pilot study purports to address the mentioned needs and serve as a springboard for future culturally sensitive research.

**Participants and Methods:** The study was performed in the Dominican Republic due to an available opportunity to conduct the research with indigenous Hispanics. It entailed administering, in a counterbalanced order, the translation of the Culture-Fair Assessment of Neuro-Cognitive Abilities (CANA) or the Evaluación Transcultural de Habilidades Neuro-Cognitivas, standard-Spanish CANA (S-S CANA) and comparing its efficacy in detecting neuropathology, to the MMSE standard-Spanish version or Examen Cognoscitivo Mini-Mental (ECM-M). This study was designed to start a validation process of the S-S CANA, and norm it to the given population. The sample was comprised of 30 Spanish-speaking Dominicans, at least 18-years-old, whom met the inclusion criteria for the normative and clinical groups.

**Results:** Analyses of Variance, Receiver Operating Characteristic, t-test, and Analyses of Covariance were conducted. Results indicated significantly greater sensitivity and specificity of the S-S CANA relative to the ECM-M.

**Conclusions:** The S-S CANA discriminative value closes the gap for clinicians having to resort to measures validated in English speaking population in the United States. This pilot study opens the door for considering the S-S CANA as a viable Spanish neuro-cognitive screening tool that will lessen the chances of individuals being misdiagnosed, given recommendations for services not needed, or being deprived of needed services.

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**L.H. LACRITZ, M. CULLUM, S. O'BRYANT, J. HALL, P. MASSMAN, S. WARING, J. REISCH & M. HARVEY. Normative Data for the Texas Card Sorting Test: A Brief New Executive Function Measure.**

**Objective:** The Texas Card Sorting Test (TCST) is a novel test of executive functioning that involves sorting 6 cards into 2 groups based on like dimensions (max sorts=10). The TCST is shorter than available executive function measures (5-7 minutes) and does not involve negative feedback. A computerized version has shown robust orbitofrontal activation on fMRI. The goal of this study was to generate normative data for the TCST in an elderly sample, assess convergent validity, and compare control performance to an Alzheimer disease (AD) sample.

**Participants and Methods:** The TCST was administered to 164 healthy controls (M age=70; M educ=15.5) and 92 AD subjects (M age=78; M education=13.6) as part of a larger test battery at one of four collaborating AD research centers. Pearson correlations were conducted with other cognitive measures, and ANCOVAs (correcting for age and education) were used to examine group differences.

**Results:** Number of Logical Sorts from the TCST was significantly ( $p < .001$ ) correlated with age ( $r = -.53$ ) and education ( $r = .37$ ), as well as other executive function measures (Trail Making Test B,  $r = -.76$ ; FAS,  $r = .65$ ). Lower but significant correlations were seen with measures of attention (Trail Making Test A,  $r = .56$ ; Digit Span,  $r = .55$ ). AD subjects completed fewer Logical Sorts (2.0 vs. 5.2;  $p < .001$ ) and made more sorting errors ( $p < .02$ ) than controls. Normative data stratified by age were derived.

**Conclusions:** Results support the validity of the TCST and feasibility for use as a brief measure of executive functioning in normal aging and dementia. Provided normative data will enhance interpretation of this measure.

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**L.H. LACRITZ, M. CULLUM, H. ROSETTI, H. HOBBS & M. WEINER. Normative Data for the Montreal Cognitive Assessment in an Ethnically Diverse Sample.**

**Objective:** The MoCA is a brief cognitive screening measure (max score=30) designed to assist with detection of Mild Cognitive Impairment (MCI). A cut-score of <26 has been proposed to maximize sensitivity/sensitivity for identification of MCI based on data from 90 healthy controls (M MoCA=27.4; range=25-30), although little is known about its normative properties within the general population. This study presents normative and descriptive data for the MoCA in a large, ethnically diverse sample.

**Participants and Methods:** The MoCA was administered to 551 ethnically diverse subjects as part of a population-based study of cardiovascular disease (M age=51.8, range=18-82; Caucasian=41%, African American=47%; Hispanic=9%). Normative data were generated by age and education. Pearson correlations and ANOVAs were conducted to examine relationship to demographic variables. Frequency of missed items was also reviewed.

**Results:** MoCA scores modestly but significantly ( $p<.001$ ) correlated with age ( $r=-.18$ ) and more strongly with education ( $r=.47$ ). Caucasians outperformed African Americans and Hispanics ( $p<.001$ ), even when controlling for age and education. Total scores were lower than expected given previously published normative data (M=24.2, SD=3.7), with 58% falling below the suggested cut-off (<26) for impairment. Most frequently missed items included the cube drawing (56%), clock hands (39%), sentence repetition (39%), verbal fluency (39%), abstraction items (39%), and delayed recall (50% <4/5 words). Normative data stratified by age and education were derived.

**Conclusions:** Results highlight the need for population-based norms for the MoCA and use of caution when applying established cut-scores, particularly given the high failure rate on certain items. Demographic factors must be considered when interpreting this measure.

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**R.C. MARTIN, K. TRIEBEL, J. HILL, H. GRIFFITH, A.P. NICHOLAS, R.L. WATTS, N. STOVER, M. BRANDON, K. BELUE & D.C. MARSON. Impaired Financial Abilities in Parkinson's Disease Patients With Cognitive Impairment.**

**Objective:** This study investigated financial capacity performance in cognitively impaired patients with idiopathic Parkinson's disease (PD).

**Participants and Methods:** A cross-sectional study of financial capacity performance was conducted with 20 healthy older controls and 35 patients diagnosed with idiopathic PD. PD patients met consensus established criteria for mild cognitive impairment (PD-MCI,  $n = 18$ ) or dementia secondary to PD (PDD,  $n = 17$ ). All participants underwent neurological and neuropsychological evaluations, and completed a standardized measure assessing a comprehensive array of financial abilities (Financial Capacity Instrument; FCI). The FCI assesses financial skills across nine conceptually-based domains (e.g., checkbook management, financial conceptual knowledge). A total score was also calculated. Norm-referenced capacity outcome classification ratings (capable, marginally capable, incapable) for each domain and total score were determined.

**Results:** Compared to controls and PD-MCI patients, PDD patients demonstrated impairment on 7 of the 9 financial domains and on the FCI total score. PD-MCI patients demonstrated impairment on three domains (basic monetary skills, financial concepts, investment decision-

making), as well as the FCI total score relative to controls. Approximately one-third of PD-MCI patients were classified as either marginally capable or incapable on 6 FCI domains and total score, while at least 73% of PDD patients were classified as incapable on 7 domains. Motor impairment and global cognitive function were both positively associated with FCI performance in the PDD group.

**Conclusions:** This study found widespread financial ability deficits in PDD patients. Emerging financial abilities deficits were also found in a substantial proportion of PD-MCI patients. These results highlight the importance of assessing instrumental activities of daily living even in PD patients thought to have mild cognitive impairment.

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**H. HAGEN, M.R. MEAGER, S. MURPHY & J.W. FINK. Convergent Validity of CVLT-II, BVMT-R, & MMSE Within Differentiated Dementia Groups.**

**Objective:** Previous studies have looked at the convergent properties of multiple neurocognitive measures in undifferentiated dementia populations. The purpose of this study was to investigate the convergent validity of two episodic-memory measures and a general screening of cognition in individuals with differentiated dementia etiologies.

**Participants and Methods:** The current study consisted of 58 individuals (mean age 75 years) seen for evaluation due to memory and associated cognitive complaints at the University of Chicago Medical Center. All participants were administered the CVLT-II, BVMT-R, and MMSE as part of a larger neuropsychological battery. Patients were assigned to groups according to diagnosis.

**Results:** Correlations between BVMT-R false score (M=4.03) and CVLT-II Trials 1-5 (M= 20.98) were moderately correlated,  $r(56)=.38$ ,  $p=.003$ . BVMT-R delay measure (M=2.02) showed moderate correlation with CVLT-II Long Delay Cued Recall measure (M=3.12),  $r(56)=.33$ ,  $p=.013$ . False positive performances were strongly correlated between the two measures,  $r(56)=.46$ ,  $p=.000$ . MMSE (M=22.12) was strongly correlated with CVLT-II Trials 1-5,  $r(56)=.54$ ,  $p=.000$ . MMSE was also strongly correlated with BVMT-R false positive scores (M=2.02),  $r(56)=.413$ ,  $p=.001$ .

**Conclusions:** Overall, the CVLT-II and BVMT-R demonstrated significant overlap with one another on initial encoding and delayed retrieval measures, which is generally consistent with previous literature. Additionally, false positive rates were also strongly correlated between the measures. The MMSE had a strong negative correlation with BVMT-R false positive performances, suggesting that as cognitive abilities decline, the ability to distinguish between learned material and false positives decreases as well.

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**J. MILLER, N.L. FICHTENBERG & S.R. MILLIS. Diagnostic Efficiency of an Ability Focused Assessment Battery with a mixed clinical sample.**

**Objective:** The Ability Focused Battery (AFB) can be characterized as a core group of well-validated neuropsychological measures that adequately assess the conventional range of cognitive domains. The present investigation examined the diagnostic efficiency of the AFB for use in clinical decision making with a mixed sample composed of both individuals with neurological brain dysfunction and individuals with pseudo-neurological symptomatology.

**Participants and Methods:** Participants were drawn retrospectively from an outpatient neuropsychological evaluation service and divided into two groups: (1) a clinical group consisting of 81 examinees with a medically documented history of brain dysfunction and (2) a control group consisting of 29 examinees who presented with various cognitive, emotional and somatic complaints without a history of neurological disorder.

**Results:** Logistic regression analyses using a global composite score correctly classified 79% of cases with a ROC curve AUC of .891. Additional models using individual domain scores also demonstrated comparable diagnostic efficiency. In particular, the most parsimonious model included three measures from the processing speed and memory functioning domains (e.g., CVLT-II, WAIS-III Symbol Search, and WAIS-III Digit Symbol – Coding). This two-domain model accurately classified 82.9% of cases. ROC curve analysis yielded an AUC of .907, the largest AUC of all tested models.

**Conclusions:** These three relatively brief measures may be an efficient screening battery in clinical and research settings.

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**C.A. NOGGLE, K. BAXTER, C. SADLER, L. CHAPMAN & J.C. THOMPSON. Altering Factor Structures of the RBANS Based on Cortical or Subcortical Dementing Etiologies.**

**Objective:** The current study investigated what component solutions may arise on the RBANS through exploratory factor analysis within populations of patients with cortical or subcortical dementing presentations.

**Participants and Methods:** An archival data set was utilized for the current study. Participants were chosen based on their diagnosis of either a cortical-based ( $n = 64$ ) or subcortical-based ( $n = 73$ ) dementia and grouped respectively. Exploratory factor analysis was run to determine what solutions of the RBANS would arise.

**Results:** Exploratory factor analysis revealed discrepancies between dementing etiologies. In regards to cortical-based dementias, analysis revealed only a 2-factor solution arose. Principle component analysis with promax rotation revealed list learning, story memory, figure copy, coding, semantic fluency, list recall, list recognition, story recall, figure and recall loaded together on Factor 1, while line orientation, picture naming, and digit span loading together on Factor 2. In comparison, exploratory factor analysis on subcortical-based dementias corresponded with a 3-factor solution with list learning, story memory, semantic fluency, list recall, list recognition, and story recall loading together on Factor 1; Figure copy, line orientation, coding, and figure recall loading together on Factor 2; and Picture naming and digit span loading together on Factor 3.

**Conclusions:** Discrepancies in factor solutions between presentations may speak to a greater breakdown of a neurocognitive hierarchy in cortical-based presentations as opposed to subcortical, which leads to aforementioned alterations to the compared component structures. Findings may also suggest a need for differential approaches to RBANS interpretation in these populations that adheres to the altered component structures.

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**J.C. THOMPSON, C.A. NOGGLE & M.T. BARISA. Correlations between Outcomes on the Word Memory Test and RBANS Subtest Performance.**

**Objective:** The current study sought to outline the relationship between performance on the Word-Memory Test (WMT) and RBANS subtests.

**Participants and Methods:** An archival data set was utilized for the present study. Participants included 72 individuals referred for neuropsychological evaluations who were administered both the RBANS and the Word-Memory test as part of a more comprehensive battery. RBANS subtest scores and WMT scores were recorded and analyzed.

**Results:** Performance on the Immediate Recall condition of the WMT was significantly related to performance on List Learning ( $r=.343$ ), Story memory ( $r=.34$ ), Figure copy ( $r=.233$ ), Line Orientation ( $r=.277$ ), Semantic Fluency ( $r=.283$ ), Coding ( $r=.347$ ), List recognition ( $r=.268$ ), Story recall ( $r=.460$ ) and Figure recall ( $r=.245$ ). Delayed recall on the WMT was significantly related to List Learning

( $r=.373$ ), Story memory ( $r=.470$ ), Line Orientation ( $r=.29$ ), Semantic Fluency ( $r=.302$ ), Coding ( $r=.354$ ), List recall ( $r=.288$ ), List recognition ( $r=.478$ ), and Story recall ( $r=.335$ ). Finally, the WMT-Consistency calculation was significantly correlated with performance on List Learning ( $r=.438$ ), Story memory ( $r=.490$ ), Line Orientation ( $r=.335$ ), Semantic Fluency ( $r=.335$ ), Coding ( $r=.373$ ), List Recall ( $r=.332$ ), List Recognition ( $r=.523$ ), Story Recall ( $r=.565$ ), and Figure Recall ( $r=.258$ ).

**Conclusions:** Results carry clinical implications as they demonstrate the general relationship between performance on the RBANS subtests and the WMT, thus offering some insight into the manner in which interpretations may be made on the prior when there is questionable performance on the latter.

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**T. OLIVARES, Y. PÉREZ, G. RAMÍREZ, A. NIETO, J. BARROSO & M. HERNÁNDEZ. Recognition Performance on Learning and Memory Tasks in Patients with Relapsing-Remitting Multiple Sclerosis (MS).**

**Objective:** Recognition procedures are not included in the majority of batteries for evaluating cognitive changes in MS. Objectives: to study learning and memory performance comparing free recall to recognition performance on verbal and visuospatial tasks.

**Participants and Methods:** 33 patients (23 f, 10 m) with R-R MS were studied. Expanded Disability Status Scale scores ranged from 0 to 2.5 ( $M=1.3$ ;  $sd=0.8$ ). The patients averaged 9.7 ( $sd=7.0$ ) years from symptom onset. 30 demographically matched healthy controls were also studied. The Selective Reminding Test (SRT) was administered adding a recognition trial after free delayed recall. Visual learning and memory was assessed using 10/36 Spatial Recall Test (SPART) including a multiple choice recognition procedure.

**Results:** SRT: the MS group performed significantly worse than the control group in the trials 4/6 ( $F(1, 61)=4.45$ ;  $p=0.03$ ); ( $F(1, 61)=8.81$ ;  $p=0.004$ ), and delayed recall ( $F(1,61)=7.21$ ;  $p=0.009$ ). Groups x recall condition (trial 6/free-delayed recall) interaction was not statistically significant indicating that the magnitude of the difference was similar in both groups ( $F(1,61)=2.59$ ;  $p=0.11$ ). Groups x recall condition (trial 6/ recognition trial) and (free-delayed recall/recognition trial) interactions were statistically significant indicating a higher benefit for the patients on recognition tasks ( $F(1,61)=4.21$ ;  $p=0.04$ ); ( $F(1,61)=5.52$ ;  $p=0.02$ ). No significant group differences were observed for the SPART.

**Conclusions:** the MS group shows a deficit in verbal free retrieval during the acquisition phase and subsequent delayed recall. We suggest that recognition tasks could be included in screening instruments as a rapid tool to define the pattern of memory dysfunction in MS patients.

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**T. OLIVARES, Y. PÉREZ, G. RAMÍREZ, A. NIETO, J. BARROSO & M. HERNÁNDEZ. Relationship of the Multiple Sclerosis Neuropsychological Questionnaire (MSNQ) to Neuropsychological and Depression Measures in Patients with Relapsing-Remitting Multiple Sclerosis.**

**Objective:** Self-report form of the MSNQ has been significantly correlated with both cognitive functioning and depression. However, divergent results have been reported and not support the use of the MSNQ-Self Report as a sensitive measure for neuropsychological impairment in MS.

**Objectives:** To examine the relationship of the MSNQ-S to neuropsychological performance and mood in a clinical homogeneous sample.

**Participants and Methods:** 33 patients (23 f, 10 m) with relapsing-remitting course were studied. Expanded Disability Status Scale scores ranged from 0 to 2.5 ( $M=1.3$ ;  $sd=0.8$ ). The patients averaged 9.7 ( $sd=7.0$ )

years from symptom onset. 30 healthy controls were demographically matched to the MS subjects. The MSNQ-S was administered to patients at the beginning of neuropsychological exam. The Brief Repeatable Neuropsychological Battery (BRBN) was utilized to assess cognition. Depression was quantified with the Beck Depression Inventory (BDI).

**Results:** The MS group performed significantly worse in Long-term storage (LTS), ( $F(1,61)=5.39$ ;  $p=0.02$ ) Consistent Long-Term Retrieval (CLTR) ( $F(1,61)=5.00$ ;  $p=0.02$ ), SRT delayed recall ( $F(1,61)=7.21$ ;  $p=0.009$ ) and phonemic fluency task (FAS) ( $F(1, 61)=5.01$ ;  $p=0.02$ ). The MSNQ-S showed significant correlations with only one neuropsychological measure: (FAS) ( $r=-.37$ ,  $p=0.05$ ). MSNQ-S was significantly positively correlated to BDI, indicating that higher self-reports of cognitive impairment were related to depressive symptoms ( $r=.51$ ,  $p=0.05$ ).

**Conclusions:** our results question the MSNQ-S as an effective screening instrument for neuropsychological impairment in patients with mildly impaired cognitive function and characterized by a short evolution and minimal levels of neurological disability. However, support the association of the cognitive complaints with symptoms of mood disorder.

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#### T.D. PARSONS, A.A. RIZZO, L.C. COSAND, C.G. COURTNEY & A.V. IYER. Development of a Neuropsychological Battery using Virtual Environments.

**Objective:** Current methods for assessing cognitive performance include traditional paper and pencil tests, motor reaction time tasks, flash screen computers, and behavioral ratings. These approaches have been criticized as having limited ecological validity. The Virtual Reality Cognitive Performance Assessment Test (VRCPAT) focuses upon enhanced ecological validity using a virtual city and a driving simulator to assess neurocognitive processing.

**Participants and Methods:** The 30 minute VRCPAT battery and a 1.5 hour neuropsychological assessment were conducted with a sample of 63 healthy adults, between the ages of 20 and 36. Our project emphasized construct validation of the VRCPAT.

**Results:** VRCPAT Memory module correlated significantly with traditional tests of Learning ( $r = 0.69$ ,  $p < 0.001$ , 48% of variance) and Memory ( $r = 0.67$ ,  $p < 0.001$ , 47% of variance). No significant correlations existed between VRCPAT Memory module and non-memory composites. Comparison of "simple" versus "complex" stimulus presentations revealed that an increase in stimulus complexity caused a significant decrease in attentional performance ( $F = 5.12$ ;  $p = 0.04$ ). Comparison of "low intensity" versus "high intensity" presentations revealed that increase in stimulus complexity caused a significant decrease in attentional performance ( $t = 9.8$ ;  $p = 0.01$ ).

**Conclusions:** Findings suggest that VRCPAT Memory module measures capacity consistent with that of traditional measures of learning and memory, and is inconsistent with potential confounds. Further, increase in stimulus complexity and stimulus intensity within a virtual environment can manipulate performance on attentional tasks.

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#### A.M. PERALTA, S.A. ROGERS & D.A. LOWE. Age Bias in Standardized Neuropsychological Measures.

**Objective:** Many clinicians may select and use standardized psychological measures without giving significant attention to the normative data used in the measures or when they were last determined. This study compares the cognitive scores of older adults and those of younger adults on two popular neuropsychological measures, the American version of the Nelson Adult Reading Test (AMNART) and the Boston Naming Test (BNT).

**Participants and Methods:** 75 unimpaired participants divided into two groups, 39 college students ages 17-21 ( $M = 18.79$ ,  $SD = .95$ ), and 37 older adults ages 56-96 ( $M = 72.39$ ,  $SD = 10.34$ ), completed the AMNART and BNT which both have age level adjusted norms.

**Results:** AMNART scores revealed older adults had significantly higher verbal IQ scores ( $M = 120$ ,  $SD = 7.16$ ) than those of young adults ( $M = 114$ ,  $SD = 5.33$ ),  $t(71) = -3.81$ ,  $p < .001$ . BNT scores revealed older adults had significantly higher z-scores ( $M = .43$ ,  $SD = 1.28$ ) than those of young adults ( $M = -0.38$ ,  $SD = 1.37$ ),  $t(68) = -2.55$ ,  $p < .05$ .

**Conclusions:** Older adults performed significantly better on the AMNART and BNT than younger adults, even with the built in correcting for age of both tests. This suggests that these tests may be highly sensitive to age and unduly favor older adults, while under-appreciating younger adults. It appears that some of the standard neuropsychological tests may not be appropriate for all ages. Discretion may therefore be necessary when utilizing these tests for younger adults.

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#### L. SOLURSH & C. PIERCE. An Analysis of Nine Estimates of Premorbid Intellectual Abilities in a General Medical Sample.

**Objective:** Many methods are available to estimate premorbid intellectual abilities. These include methods that consider demographic variables and some combination of demographic variables and current performance. The decision about which approach would yield the optimal estimate is unclear. In the current study, we compared the performance of nine different premorbid IQ estimation techniques.

**Participants and Methods:** The subjects were a group of 130 consecutive patients with various diagnoses seen for a neuropsychological evaluation at an urban medical center. The methods evaluated included the original and revised Barona formulas (Barona et. al., 1984, Barona & Chastain, 1986) the five OPIE-3 formulas (Schoenberg et. al., 2002), and the Wechsler Test of Adult Reading demographics only and demographics plus reading scores (Wechsler, 2001).

**Results:** All estimates correlated significantly ( $p < .001$ ). The OPIE-3 formulas produced the greatest degree of kurtosis and were generally more skewed, but not significantly so. In fact, none of the estimates produced a significantly skewed or kurtotic distribution. The Barona formulas, particularly the revised version, tended to yield the highest estimates. All means, with the exception of the revised Barona, clustered around 100. The OPIE-3 formulas produced standard deviations around 15 while other estimates produced standard deviations of less than 10.

**Conclusions:** No estimate method was clearly superior to the others. In light of these data, the best approach to estimating premorbid intellectual functions would be to calculate multiple estimates and consider each in light of their strengths and weaknesses.

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#### A.M. POREH, K. BRYANT, A. SULTAN, A. MILLER, KAY, S. MAGNUSON & P. DINES. Decomposition of the Trail Making Test Using One-on-One Computer Assisted Testing.

**Objective:** The present study assessed the reliability and validity of a computer assisted software to decompose the Trail Making Test (TMT) into five sections.

**Participants and Methods:** One hundred and forty randomly sampled adults completed the Trail Making Tests Parts A and B. The average age was 38.2 ( $Sd=21.3$ ) and the average years of education was 14.5 ( $SD=2.5$ ). The majority of the subjects were female (58.6%) and right handed (94.7%). Subjects were administered the TMT in the traditional fashion, using a pencil and paper. As the subject connected the circles with his/her pencil, the examiner clicked on a mouse and recorded the latency from one circle to the next. The data for each part of the TMT were then collapsed into 5 separate indexes composed of 5 circles.

**Results:** The data were divided into 7 age groups. The mean scores were then correlated with Tombaugh's (2004) published norms. The correlation between Tombaugh's norms and the current study was  $r=.978$  and  $r=0.957$  for Trails A and B, respectively. The correlation

between the two derived indexes derived from division and subtraction of the Trails A and B was also high ( $r=.897$  and  $.919$ , respectively). Internal consistency of the five sub-sections of the TMT across the different groups ranged from  $.47$  to  $.83$  for Part A and  $.69$  to  $.86$  for Part B. Incremental validity of the section by section decomposition was examined using stepwise multiple correlation analysis with the dependent measures being the Five Point Test and the planning indexes of the Geriatric CFT. Only the last portion of the TMT Part B entered into the model.

**Conclusions:** The results of the present study support the compatibility of the computer assisted platform for data collection of the Trail Making Test with traditional pencil and paper testing. The study also shows that decomposing this test may add valuable data to the understanding of the TMT. Additional research using patients who are suffering from neurological deficits is needed to further support these findings.

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**B. REED, D. WOODS, W. YUND, J. CRANE & M. BATES. A Computer Adaptive Test Battery for Epidemiological Neurotoxicology.**

**Objective:** Computer-controlled cognitive tests potentially improve standardization and, with computer-adaptive testing, can efficiently estimate ability.

**Participants and Methods:** The aim of this battery is to rapidly assess cognitive domains sensitive to neurotoxic insults: psychomotor speed, attention, perceptual processing, and working memory. It is intended to be supplemented by tests of other domains, such as fine motor skills and memory.

Tests were refined with iterative pilot testing. The tests are: 1) Finger tapping, which measures rapidity and consistency of key pressing. 2) simple reaction time (RT), which measures RT to a target presented at variable interstimulus intervals (ISI) in each hemifield. 3) Visual feature conjunction, measuring RT and detection accuracy to a color/shape target and non-targets sharing color, shape, or no features with the target. 4) Digit span (forward and reverse) 5) Paced Auditory Serial Addition Test (PASAT) which requires serial addition using digits 1-5. All tests except tapping are adjusted adaptively based on response accuracy.

Data are from 196 participants in the Community Hydrogen Sulfide Exposures and Effects: the Rotorua Study (CHEERS), a cross sectional epidemiological study of the effects of chronic low level H<sub>2</sub>S exposure.

**Results:** Age ranged from 18-65, mean = 47.6. Level of education was very variable. Mean time of administration was 30.0min (range 24min – 36min). Valid data were obtained for all subjects for all measures except PASAT, which 93% of subjects completed. Expectable demographic effects are observed: for example, age is moderately related to tapping speed and visual conjunction (complex) RT ( $R^2s = .26-.28$ ) and weakly related to simple RT ( $R^2 = .04$ ).

**Conclusions:** The battery is brief and very well tolerated. Data collection is ongoing. We will present data on basic test parameters, the extent to which they covary, and their demographic predictors. H<sub>2</sub>S exposure data are not yet available.

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**L. RENTERIA, H. HAGEN, L.A. SWOROWSKI & D.S. GOLDSTEIN. The MMPI-2 and Personnel Selection: An Examination of Bias in the Screening of Hispanic Public Safety Officers.**

**Objective:** Despite being widely used, the MMPI-2 has not been adequately examined to determine whether there are ethnicity-based differences on the validity and clinical scales between Hispanic and Caucasian public safety candidates. Research thus far indicates that there are ethnicity-based differences on L and K that may place Hispanics at

a disadvantage during selection screening (Campos, 1989; Kornfeld, 1995). The present investigation was designed to assess whether Hispanic and Caucasian public safety candidates perform differently on MMPI-2 validity or clinical scales and whether this has led to adverse impact.

**Participants and Methods:** Participants were 78 Hispanic and 78 Caucasian public safety candidates who were administered the MMPI-2 as part of a larger pre-employment psychological screening evaluation. Both groups were matched according to age ( $M = 30$ ), education ( $M = 14$ ) and gender (males = 64, females = 14).

**Results:** Independent samples t-tests revealed no significant mean difference on the validity scales but a significant difference on clinical scales 2 ( $t = -2.40$ ,  $p < .05$ ) and 5 ( $t = -2.23$ ,  $p < .05$ ). The mean score for Hispanics was higher on both of these scales. An item analysis was conducted with select scales to examine potential cultural bias and to better understand differential responding among Hispanics. Acceptance rates based solely on the MMPI-2 as well as interview and other test data was examined for the potential of adverse impact.

**Conclusions:** Evidence garnered from this study suggests that the MMPI-2 predicts job performance criteria equally well for Hispanics and Caucasians. More research is needed to understand how other sociodemographic variables may influence test results.

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**P. ROSKOS, J.N. HOOK & B. PYYKKONEN. The MMPI-2 Fake Bad Scale (FBS) in Depressed and Non-Depressed Epilepsy Patients.**

**Objective:** The FBS was originally developed to detect somatic malingering in personal injury litigants. Research has shown the scale to be useful across multiple patient populations, including traumatic brain injury litigants and psychiatric trauma cases. Less research has examined the FBS in non-compensation seeking clinical groups. The current study aimed to examine the properties of the FBS in two groups of patients who were not known compensation-seekers. Differences in FBS scores and mean MMPI-2 profile scores were expected between groups.

**Participants and Methods:** The sample was obtained from inpatient and outpatient referrals by the epilepsy center to the neuropsychology service at a large urban hospital. Depressed and non-depressed groups were identified within the sample of epilepsy patients. Depression status was based on positive self-report during interview and elevation on scale 2 of the MMPI-2 ( $T \geq 65$ ). In addition to the MMPI-2, all patients were administered a battery of cognitive tests.

**Results:** Preliminary data analyses revealed statistically significant differences between groups, with depressed patients having a higher mean FBS score. Multiple clinical scale mean scores were also significantly higher in the depressed group. Regardless of group, mean FBS scores were below suggested cutoffs for suspected somatic malingering and the proportion of patients with scores above the cutoff was low.

**Conclusions:** Findings extend research with the FBS and support its validity as a measure of somatic malingering.

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**D.W. SCHARRE, S. CHANG, D. BEVERSDORF, M. KATAKI, H. NAGARAJA & R. BORNSTEIN. Self-Administered Gerocognitive Examination (SAGE): Validity and Reliability of a Brief Cognitive Screening Instrument for Detection of Early Dementia.**

**Objective:** Most cognitive screening tests are underutilized due to the time and personnel resources to administer them. To facilitate screening for dementia, we developed SAGE, a self-administered test that does not require administrative time. Our aim was to measure the validity and reliability of SAGE to detect mild dementia against the gold standard clinical assessment with neuropsychological evaluation.

**Participants and Methods:** SAGE measures cognitive function in the domains of orientation, language, memory, executive function, calculations, abstraction, and visuospatial abilities. Scores range from 0-22. Subjects, age over 59 with sufficient vision and English literacy, were recruited from a wide variety of clinic and community settings. After SAGE screening, subjects were randomly selected to participate with a clinical evaluation including history, neurological examination, functional assessment, and neuropsychological battery. Subjects identified by standard clinical criteria and neuropsychological testing as either demented or normal were analyzed.

**Results:** 241 participants took the initial SAGE screen. 32 subjects completed the extensive evaluation and were diagnosed as normal ( $n=21$ ) or demented ( $n=11$ ). Pearson correlation between SAGE and the neuropsychological battery was 0.85. Inter-rater reliability of SAGE scoring was 0.96. SAGE test-retest showed a correlation of 0.87. Receiver Operating Characteristics of SAGE based on clinical diagnosis showed 100% sensitivity and 95% specificity in detecting dementia from normal subjects. The predictive positive and negative values of SAGE are 92.5% and 100%.

**Conclusions:** This study suggests that SAGE is a valid and reliable self-administered instrument for detecting dementia. The self-administration feature may enhance utilization prompting earlier diagnosis and treatment.

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#### L.M. SILVA & S.P. VERNEY. Information Processing Speed and Efficiency: Associations with WAIS-III Factors.

**Objective:** Standardized cognitive ability tests rely heavily on response speed, theorized to index information processing, one of the more important cognitive components of intelligence. Speed of information processing is the time required for stimuli to be perceived, understood, and acted upon. However, information processing speed and efficiency are often considered overlapping constructs with a timed processing speed component on standardized cognitive ability tests. The visual backward masking task (VBM) has been used extensively to investigate early stages of processing efficiency by quantifying the amount of time required to pass information through the sensory register. The purpose of this study was to investigate the associations between VBM performance and WAIS-III factor scores.

**Participants and Methods:** Ninety-five students (48% European American, 52% ethnically diverse; 65% female, mean age=22.0 years) completed seven subtests of the WAIS-III, used to estimate WAIS-III index scores, and a computerized VBM, used to assess early information processing efficiency.

**Results:** Significant correlations were found between the VBM 83 ms condition and the Processing Speed Index ( $r=0.21$ ), and the Perceptual Organization Index ( $r=0.21$ ). Significant correlations were also found between the VBM 117 ms condition and the Verbal Comprehension Index ( $r=0.22$ ) and overall Verbal IQ ( $r=0.19$ ). Both the 83 and 117 ms conditions, which provide the most challenging VBM conditions, correlated significantly with both Performance IQ ( $r=-0.21$ ,  $r=.020$ ) and Full Scale IQ ( $r=0.20$ ;  $r=.022$ ).

**Conclusions:** These findings add further evidence that VBM performance indexing efficiency of processing underlies a general cognitive ability rather than a specific processing speed component of higher-order cognitive tests.

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#### N.H. STRICKER, J.S. SADEK, J.M. TYBUR & K.Y. HAALAND. Neuropsychological Assessment Battery: Performance after Left or Right Hemisphere Stroke.

**Objective:** The Neuropsychological Assessment Battery (NAB) is a new battery that is used clinically. However, no study has examined the NAB profiles in right versus left hemisphere damage (RHD, LHD).

**Participants and Methods:** We studied such patients (18 RHD, 24 LHD, confirmed by imaging) with age- and education-matched healthy controls (36 HC). We predicted that the LHD group would perform worse than the RHD and HC groups on the domains of Language and Memory, which contain predominantly verbally-mediated tests, and that the RHD group would perform worse than the LHD and HC groups on the Spatial domain. Specific predictions were not made for the NAB total score and the Attention and Executive domains because these domains were not obviously dominated by verbal or spatial tasks.

**Results:** As predicted, the LHD group performed significantly worse than the RHD group on the Memory domain, and this effect was related to the larger number of verbal measures that contribute to the Memory Domain Score. However, the RHD group performed similarly to the LHD group on the spatial memory subtests, and the RHD group's poorer performance relative to the LHD group on the Spatial domain only approached significance ( $p = .07$ ). There was not a significant difference between the two stroke groups on the Language domain. Both stroke groups performed significantly worse than the HC group and similar to each other on the NAB total score and on the domains of Attention, Executive Function, and Language.

**Conclusions:** From a classical model of hemispheric specialization, the NAB appears sensitive to hemisphere-specific deficits though the lack of significant differences on some tests raises construct validity concerns.

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#### K.L. VOTRUBA & S.A. LANGENECKER. Age- and Education-Based Normative Data for the Parametric Go/No-go (PGNG) Task.

**Objective:** The construct of inhibitory control is important in the diagnosis and treatment of cognitive disorders. Although commonly administered measures of executive functioning are useful in assessing broadly defined deficits in frontal lobe functioning, they are often insensitive to specific aspects of executive functioning. It is critical that reliable measures of inhibitory control emerge to enable accurate identification of people with such deficits.

**Participants and Methods:** Participants included 183 individuals aged 18 to 70 ( $M = 31.7$ ,  $SD = 14.5$ ;  $Md = 25.0$ ). The mean educational level was 15.1 years ( $SD = 2.5$ ;  $Md = 15.0$ ). The female to male ratio was 101 to 74 with 8 unidentified participants. The PGNG consists of three levels, completed in order of ascending difficulty. The first level is a standard continuous performance test measuring accuracy and average response time in response to three targets in a serial stream of visually presented letters. The second level adds a non-repeating rule, measuring mean response time to two targets, accuracy for targets, and inhibition accuracy for repeated responding to the same target. The third level has the same dependent variables, but now has three targets with the same non-repeating rule.

**Results:** Normative data for the Parametric Go/No-go task are presented stratified according to age and education. Performance declined as participants aged and as the task became more difficult.

**Conclusions:** It is expected that use of these norms will assist in more accurately identifying individuals that have difficulties with reaction time, sustained and complex attention, and different inhibitory processes.

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#### F. WOON, C.J. BECK & R.O. HOPKINS. Use of Cognitive Screening Tests to Identify Cognitive Impairments in Survivors of Critical Illness.

**Objective:** There is growing recognition that long-term cognitive functioning is impaired in critically-ill patients. However, previous stud-

ies provided little information regarding early identification of which patients are at risk to develop cognitive sequelae using brief and easily-administered cognitive screening tests. This study assessed cognitive function using two cognitive screening tests, the Mini-Mental Status Exam (MMSE) and Mini-Cog, prior to hospital discharge in ICU survivors.

**Participants and Methods:** Study inclusion criteria were mechanical ventilation >48 hours and patient age >18 years. Study exclusion criteria were disease states that are irreversible, central nervous system injury, and preexisting cognitive impairment. Fifty-five patients (30 males and 25 females with a mean age =53.3±18 years; mean education =13.4±2.3 years) were administered the MMSE and Mini-Cog prior to hospital discharge. Admission diagnoses included trauma without brain injury N=11, sepsis N=11, pneumonia/respiratory failure N=10, cardiac disease N=10, surgery N=5, gastrointestinal disease N=4, renal failure N=3, and neurologic N=1.

**Results:** Thirty-four (62%) patients were impaired on the MMSE (score <27) while 26 (47%) patients were impaired on the Mini-Cog (word recall score =0 or 1 to 2 with impaired clock drawing). Further, 21 (38%) patients were impaired on both the MMSE and Mini-Cog compared to 15 (27%) patients who scored within the normal range on both tests.

**Conclusions:** At hospital discharge, a significant number of critically-ill survivors have cognitive impairments. It is unknown whether cognitive impairments at hospital discharge assessed using cognitive screening tests will predict long-term cognitive impairments. Early detection of cognitive impairments may expedite referrals for neuropsychological evaluation or treatment.

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**M.J. WRIGHT, E. WOO, M. SCHMITTER-EDGEcombe, C.H. HINKIN, E.N. MILLER & A.L. GOODING. Rationale, Psychometrics, and Application of the Item-Specific Deficit Approach (ISDA).**

**Objective:** To evaluate the ISDA, a new analytic method for characterizing memory deficits on list learning measures.

**Participants and Methods:** The ISDA was applied to California Verbal Learning Test (CVLT) data from 132 participants [53 healthy & 79 neurologically compromised (NC)]. Digit Span and Logical Memory were collected from a subset of participants.

**Results:** The NC group had worse CVLT performance,  $F(2,129) \geq 33.00$ ,  $\eta^2 \geq 0.34$ . In inattentive participants, the ISDA encoding index was not related to Digit Span ( $r = -0.10$ ); traditional indices were associated with Digit Span (total 1-5,  $r = 0.33$ ; learning slope,  $r = -0.25$ ). In the overall sample, traditional consolidation (forgetting) and retrieval (recognition-recall) indices were associated ( $r = -0.45$ ), while the ISDA consolidation and retrieval indices were not ( $r = 0.03$ ). The ISDA encoding, consolidation, and retrieval indices showed acceptable internal consistency for descriptive markers ( $\alpha = 0.66-0.84$ ). In terms of validity, the ISDA discriminated between NC and healthy groups [Wilks'  $\lambda = 0.33$ ,  $\chi^2(3) = 143.45$ ,  $cr = 0.82$ ,  $\eta^2 = 0.67$ ] and correctly classified 93.2% of the participants (92.4% sensitivity, 94.3% specificity). The traditional indices discriminated these groups [Wilks'  $\lambda = 0.60$ ,  $\chi^2(3) = 64.31$ ,  $cr = 0.63$ ,  $\eta^2 = 0.40$ ] and correctly classified 82.2% of them (90.6% sensitivity, 78.9% specificity). The ISDA predicted impaired Logical Memory performances [Wilks'  $\lambda = 0.65$ ,  $\chi^2(3) = 26.41$ ,  $cr = 0.59$ ,  $\eta^2 = 0.35$ ] and correctly classified 82.4% of these (74.0% sensitivity, 89.3% specificity). The traditional indices predicted Logical Memory deficits [Wilks'  $\lambda = 0.79$ ,  $\chi^2(3) = 11.25$ ,  $cr = 0.46$ ,  $\eta^2 = 0.21$ ] and correctly classified 72.5% of these (93.0% sensitivity, 48.0% specificity).

**Conclusions:** The ISDA was shown to be reliable, valid, and unrelated to the confounding effects of inattention. These findings suggest that the ISDA provides advantages over traditional indices for identifying specific memory deficits.

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**A.L. ZARTMAN, S.N. GORDON, K.R. KRUEGER, K. VANBUREN & R.C. HILSABECK. Utility of the Effort Index (EI) of the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) in a Heterogeneous Geriatric Sample.**

**Objective:** Administration of symptom validity tests is a practice guideline but may be unfeasible in some clinical settings. Efforts have been made to develop validity indexes using existing variables within neuropsychological batteries. Silverberg et al (2007) proposed an effort index (EI) for the RBANS composed of the summation of digit span and list recognition weighted raw scores that was effective in detecting poor effort in a mild TBI cohort. The purpose of this study was to determine the utility of the RBANS EI in a heterogeneous geriatric sample.

**Participants and Methods:** Participants were 74 veterans (95% men) ranging in age from 56 to 88 years ( $M = 67.8$ ) with an average education of 13.1 years ( $SD = 3.2$ ). Most were Caucasian (62%) or Hispanic (24%). No participant was suspected of poor effort, verified by passing scores on the Test of Memory Malingering (TOMM) in a small subsample ( $N = 11$ ). All participants completed the RBANS as part of a comprehensive neuropsychological evaluation. EI scores were calculated as described in Silverberg et al (2007), with scores > 3 suggestive of poor effort.

**Results:** Total sample Axis I diagnoses were Dementia (32%), Cognitive Disorder, NOS (30%), Mild Cognitive Impairment (MCI; 11%), miscellaneous psychiatric disorders (25%), and no diagnosis (2%). 15 individuals (20%) obtained an EI score greater than 3. Of these, 2 were diagnosed with Cognitive Disorder NOS, 7 with Dementia, and 1 with MCI.

**Conclusions:** The EI should be used cautiously with geriatric populations as 20% of the current sample met the criterion for poor effort, but diagnosed with valid cognitive disorders.

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## Executive Functions/Frontal Lobes

**J.B. WALKER, T. THIEU, J. DUDA, D. WEINTRAUB, M. STERN & P.J. MOBERG. Application of the Oral Trail Making Test in a Mixed Movement Disorder Sample.**

**Objective:** The Trail Making Test (TMT) is a commonly used neuropsychological measure of overall cerebral integrity. Despite its wide use and sensitivity, this measure can be affected by other non-target factors including visual problems and movement disruption. Most recently, an oral version of the TMT has been developed to help avoid some of the aforementioned limitations. Despite the potential use of a non-motor variant of this test, there has been little investigation into the use of the oral version in patients with neurologically-based movement disorder. This study examined performance on both oral and written versions of the TMT in a mixed movement disorder sample.

**Participants and Methods:** Oral and written versions of the TMT were administered in a counterbalanced manner to a convenience sample of 35 movement disorder patients. A brief neuropsychological screening was also concurrently obtained.

**Results:** Analysis revealed that most patients demonstrated significant deficits on both versions of the TMT based on published normative data. While Part B of the written and oral versions were significantly correlated with each other, no significant correlations were seen between the two versions of Part A. Notably, degree of motor dysfunction was significantly related to written TMT performance but not oral scores. Both written and oral versions of Part B of the TMT were related to independent measures of executive function.

**Conclusions:** These findings suggest that the oral version of the TMT may provide important additional information about cognitive processing and set-shifting in patients with movement disorders.

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## Forensic Neuropsychology

### K.L. CURTIS, R. BRASSEUX, K.W. GREVE & K.J. BIANCHINI. Classification Accuracy of the Seashore Rhythm Test and Speech Sounds Perception Test to Malingering in Traumatic Brain Injury.

**Objective:** A criterion groups validation (known-groups design) was employed to determine the classification accuracy of the Seashore Rhythm Test (SRT) and Speech Sounds Perception Test (SSPT) in detecting Malingered Neurocognitive Dysfunction (MND) in traumatic brain injury (TBI).

**Participants and Methods:** Mild TBI patients (mTBI;  $N = 54$ ) were classified into a not-MND group ( $n = 25$ ) or MND group ( $n = 29$ ) based on the Slick et al. (1999) criteria for MND. A Not-MND moderate/severe TBI group (M/S TBI;  $n = 23$ ) and Clinical group ( $n = 94$ ) were included for comparison. Classification accuracy of raw scores and T-scores was examined to determine which were most accurate at differentiating malingering from non-malingering.

**Results:** ROC analyses showed both tests were accurate at differentiating malingered from non-malingered performance in mTBI. Only the SSPT was able to differentiate malingered performance from the performance of the M/S TBI and Clinical groups. In mild TBI, sensitivities of 14% (SRT T-score) and 38% (SRT-raw) and 52% (SSPT T-score) and 59% (SSPT raw) were achieved at 96% specificity (i.e., 4% false positive [FP] error rate). Higher FP rates occurred in the M/S TBI and Clinical groups at the 4% FP cut-off scores established in the mTBI group.

**Conclusions:** The present study demonstrates good classification accuracy in mTBI using the SSPT and SRT. However, sensitivity was affected when using T-scores for the SRT. Sensitivity was also adversely affected in groups with objectively documented neuropathology. Therefore, caution is warranted when using these tests to detect malingering in patients with significant neuropathology.

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### J. DENBOER, S. HALL & L. HANE. Memory for Complex Pictures (MCP) vs. the Word Memory Test (WMT): Sensitivity and Specificity.

**Objective:** Sensitivity and specificity are very important psychometric components of any neuropsychological measure. These factors are particularly vital components of symptom validity tests (SVT's). This study compared the sensitivity and specificity of an established and popular SVT, the WMT (Green, 1996), with a new SVT, the MCP (DenBoer & Hall, 2008).

**Participants and Methods:** Undergraduate students ( $n=27$ ) without a history of neurological, psychological, or alcohol/drug problems were randomly assigned to either perform to the best of their ability (controls;  $n = 13$ ), or fake non-existing cognitive impairment (brain injury simulators;  $n = 14$ ). Brain injury simulators received detailed instructions to fake bad prior to administration of the measures. The administration of the SVT's were counterbalanced. Following administration of the SVT's, all participants were administered a brief battery composed of standard neuropsychological measures.

**Results:** Using Trial 2  $< 44$  as the cutoff score, the MCP, when used alone, correctly identified 13 out of 14 brain injury simulators as giving suboptimal effort (93%). The WMT, when used alone, also correctly identified 93% of brain injury simulators as malingering. Both the MCP and the WMT demonstrated 100% specificity, with neither test demonstrating any false positive errors. Controls performed very well on the MCP, obtaining an average score of 49.15 on Trial 1 ( $SD = .90$ ) and an average Trial 2 score of 49.69 ( $SD = .48$ ).

**Conclusions:** As hypothesized, the MCP and WMT demonstrated equal sensitivity and specificity. These results are commensurate with previous work on the MCP showing excellent sensitivity and specificity (e.g., DenBoer, Hall, & Zade 2008).

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### M.L. ROWLEY-PUTNEY, R. DENNEY & C.A. PIETZ. Accuracy of the MMPI-2 Fake Bad Scale, Response Bias Scale, and Henry-Heilbronner Index in Detecting Definite Malingered Neurocognitive Dysfunction Among Male Criminals.

**Objective:** The MMPI-2 28-item Response Bias Scale (RBS) and Henry-Heilbronner Index (HHI) are new scales designed to detect negative response bias related to neurocognitive functioning. This study is the first to use a known groups design to investigate the comparative predictive validity of the Fake Bad Scale (FBS), RBS, and HHI in a male criminal population.

**Participants and Methods:** Results derived from archival data of 185 male inmates evaluated for neurocognitive concerns. Cases which included MMPI-2 and at least two independent symptom validity tests were included in the study. The sample was further reduced to include only cases with no positive free standing malingering tests and those performing below random on at least one forced-choice symptom validity test. The final sample ( $N = 51$ ) consisted of 28 valid profiles and 23 Definite Malingered Neurocognitive Dysfunction profiles.

**Results:** All indices were significantly different between groups with these effect sizes: FBS ( $d = 1.147$ ), RBS ( $d = 1.308$ ), and HHI ( $d = 1.341$ ). ROC analysis identified these AUCs: FBS = .792; RBS = .814; and HHI = .823. FBS cut score of  $\geq 24$  resulted in it's greatest classification rate of .884, with specificity of .929 and sensitivity of .435. RBS cut score of  $\geq 16$  resulted in it's greatest classification rate of .884, with specificity of .929 and sensitivity of .522. HHI cut score of  $\geq 11$  resulted in it's greatest classification rate of .907, with specificity of .964 and sensitivity of .522.

**Conclusions:** All three indices appear to have predictive validity as measures of neurocognitive malingering in the criminal setting.

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### K.M. BALILES, J.N. DODD, N.A. DEFILIPPIS & F. HILL. The Relationship Between the Booklet Category Test Malingering Index and Other Measures of Malingering.

**Objective:** Multiple studies have indicated the Booklet Category Test (BCT) to be effective in detecting malingering with a cutoff score of 2 errors on subtests I and II. The purpose of this study is to examine the relationship between the BCT Malingering Index (MI) and validated malingering measures; including the Test of Memory Malingering (TOMM), Rey Fifteen-Item Test (RFIT), Victoria Symptom Validity Test (VSVT), Reliable Digit Span (RDS), and the Structured Inventory of Malingered Symptoms (SIMS).

**Participants and Methods:** Archival data of 50 forensic neuropsychological evaluations was obtained. Participant's included 32 males and 18 females, ranging in age from 18 to 67 with a mean age of 47. Education ranged from 9 to 20 years with a mean of 14.7. FSIQ scores ranged from 76 to 141 with a mean of 100.4 (14.7). The BCT MI was coded as 1 if above the cutoff score indicating malingering. Other malingering measures were coded as 1 if they indicated malingering, and 0 if the did not. Phi Coefficient was used to analyze the relationship between the BCT MI and each malingering measure. Specificity and sensitivity for the BCT MI were also calculated.

**Results:** There were no significant results for a one-tailed Phi Coefficient, suggesting no correlation between the BCT MI and other malingering measures. The BCT MI had a 0% agreement rate with other malingering measures in it's detection of suboptimal effort. The BCT exhibited 0% sensitivity and 90% specificity for detecting malingering.

**Conclusions:** Results do not support the use of the BCT MI in the use of detecting malingering.

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**R.C. HILSABECK, A.L. ZARTMAN, S.N. GORDON, K. VAN BUREN & K.R. KRUEGER. Utility of a Lower Cut-Off Score on Trial 1 of the Test of Memory Malingering (TOMM).**

**Objective:** Trial 1 of the Test of Memory Malingering (TOMM) is used as a screening measure of effort. Horner and colleagues (2006) found that scores  $\geq 36$  on Trial 1 were 99% predictive of passing the TOMM, but this finding has not been replicated. This study sought to replicate this result and establish concurrent validity with the California Verbal Learning Test-2 (CVLT-2) Forced Choice (FC) raw score.

**Participants and Methods:** 187 veterans (82% men) completed both the TOMM and the CVLT-2 as part of a neuropsychological evaluation. Average age of the sample was 48.3 years ( $SD=10.3$ ), and average education was 13.1 years ( $SD=2.6$ ).

**Results:** 166 (89%) veterans obtained passing scores on the TOMM. Of those who passed the TOMM, 45 (27%) failed to obtain scores above 44 on Trial 1, with 11 (7%) obtaining scores  $< 36$ . Most (91%) obtained passing scores on the CVLT-2 FC. Of the 21 veterans who failed the TOMM, 6 (29%) obtained TOMM Trial 1 scores  $\geq 36$ , with 67% obtaining passing scores on the CVLT-2 FC.

**Conclusions:** Lowering the TOMM Trial 1 cut-off score to  $\geq 36$  for veterans would correctly identify 93% that pass the TOMM but incorrectly identify 29% as passing who went on to fail. The CVLT-2 FC raw score does not aid in discriminating those with passing scores on the TOMM. Correspondence: Robin C. Hilsabeck, Ph.D., Psychology Service (116B), South Texas Veterans Health Care System, 7400 Merton Minter Blvd., San Antonio, TX 78229. E-mail: Hilsabeck@uthscsa.edu

**M. MARIANI, R. HANKS & S. MILLIS. Assessing insufficient effort using the yes/no recognition trial of the CVLT-II.**

**Objective:** The number of correct responses endorsed in the CVLT yes/no recognition trial has proven effective in distinguishing between patients with genuine traumatic brain injuries (TBI) and individuals supplying inadequate effort during evaluations (Millis et al., 1995). Mariani et al. (2008) found that the number of novel and semantically unrelated foils from the CVLT-II could also differentiate between these two patient groups. Thus, the present study sought to investigate the utility of the aforementioned variables to detect insufficient effort output using a known-groups design.

**Participants and Methods:** The total sample was made up of 82 patients with unequivocal moderate-severe TBI and 31 litigants with questionable TBI who had claimed pervasive deficits and who had failed at least two effort tests. The CVLT-II was administered as part of a comprehensive battery.

**Results:** The variables analyzed in this study were number of hits and types of recognition foils endorsed—i.e., novel/semantically unrelated (UN), novel/semantically related (PR), list B/semantically unrelated (BN), and list B/semantically related (BS). A test of the full model with all the predictors against the constant-only model was statistically significant,  $\chi^2(5, N = 113) = 83.10, p < .001$ . The resulting equation was  $4.46 + 5.93(\text{UN}) - 1.58(\text{PR}) - 0.41(\text{Hits}) - 0.31(\text{BS}) - 0.01(\text{BN})$ . The model correctly classified 92% of participants; with 77.4% sensitivity and 97.6% specificity. Model discriminability was excellent, as indicated by the area under the ROC curve of 0.95.

**Conclusions:** The results of this study showed that this multivariate model reliably distinguished between patients with genuine TBI and litigants giving poor effort.

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**A.L. SHANDERA, D. BERRY, L. GRAUE, J. CLARK, L. SCHIPPER & M. SOLLMAN. Cross-Validation of a Test Battery for Use in the Detection of Malingered Mental Retardation.**

**Objective:** In the wake of the 2002 U.S. Supreme Court decision (Atkins vs. Virginia) which made it illegal to sentence persons with mental retardation to death, an increasing number of researchers have turned

their attention to the issue of malingered mental retardation (MR). Graue et al. (2007) investigated the use of several psychiatric and neurocognitive malingering tests to discriminate between genuine and feigned MR and found that the recommended cutting scores for many of the neurocognitive faking measures needed to be modified to prevent misclassification of honest MR participants. The current study attempted to cross-validate the Graue et al. revised cutting scores and to explore the utility of additional malingering tests.

**Participants and Methods:** A battery of tests including: intellectual, academic, competency to stand trial, psychiatric and neurocognitive malingering measures was administered to persons diagnosed with mild MR and community volunteers directed to either respond honestly or fake mental retardation.

**Results:** Results from the study were mixed, with good replication of specificity but not sensitivity for the Graue et al. cutting scores. The additional faking measures produced similarly weak sensitivity.

**Conclusions:** Overall, the existing tools for detecting psychiatric and neurocognitive malingering do not appear to be as successful in distinguishing between feigned and genuine mild MR. It seems likely that the best method of assessing for malingered MR is to develop tests dedicated to identifying feigned intellectual deficits.

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**I. STROESCU, M.V. OLIVERI, J.D. GFELLER & M.J. ROSS. Response Bias in Clinical Neuropsychology: A Factor Analytic Examination of Validity Indicators in the WMT, VSVT, and MMPI-2.**

**Objective:** The present study explored the relationships between response validity measures when both psychological validity scales and cognitive effort measures were utilized. Following findings by Nelson et al. (2007), the aim of this study was to further delineate the varied or distinct ways in which invalidity is expressed and detected by symptom validity measures in a mixed clinical and medicolegal sample.

**Participants and Methods:** The mixed neurological sample, with traumatic, cerebrovascular, neurodegenerative, psychiatric, and other etiologies, consisted of 108 outpatient clinical and medicolegal cases (mean age = 43.3, mean education = 13.3 years, and 43.5% male) who completed the Word Memory Test (WMT; Green, 2003), the Victoria Symptom Validity Test (VSVT; Slick et al., 1995), and the MMPI-2 (Butcher et al., 1989), as part of a comprehensive neuropsychological assessment at a Midwestern medical center.

**Results:** Exploratory factor analyses were conducted using Principal Components Analysis with Varimax rotation. A four-component solution accounting for 84% of variance emerged: Component I = *cognitive effort, subtle* (WMT and VSVT-difficult accuracy scores); Component II = *psychological response bias* (traditional MMPI-2 validity indicators: F, K, F-K); Component III = *cognitive effort, obvious* (VSVT latencies and VSVT-easy accuracy); and Component IV = *cognitive/somatic response bias* (contemporary validity scales: FBS, RBS), partially replicating results reported by Nelson et al. (2007).

**Conclusions:** Neuropsychological investigations exploring response bias typically address two areas: cognitive effort and psychological response validity. While these two facets of validity are commonly interrelated, and may co-occur in examinees, these results indicate that they should be conceptualized as distinct factors or constructs.

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**H.G. TRONTEL, L. HANE, S. HALL, T. KIMPTON & J. DENBOER. Face Validity of Effort Tests: Early vs. Late Warning About the Presence of Effort Tests.**

**Objective:** To determine if the face validity of effort measures is affected by the timing of a warning that some of the tests are designed to detect faking. It was hypothesized that receiving the warning prior to taking the test battery (early) will decrease face validity of the effort tests while receiving the warning after taking the tests (late) will have no effect.

**Participants and Methods:** Twenty-seven psychology students were randomly assigned to either a coached brain injury simulator (CBIS) group or a control group. These participants were further divided into early or late warning groups. Participants were administered two effort tests, the Test of Memory Malingering (TOMM) and Memory for Complex Pictures (MCP), as part of a battery of standard neuropsychological tests. After completing the tests, they were asked to indicate what they thought each test was designed to measure. Responses were coded (e.g., memory, attention, learning) and average confidence ratings in those judgments were calculated.

**Results:** Face validity for both effort tests was significantly lower for the early-CBIS group. That is, fewer participants endorsed these tests as measuring aspects of cognition and some actually suspected that they were designed to measure effort. For the late-CBIS, early-Controls, and late-Controls, face validity was uniformly high. Participant's confidence in their judgments were high in all groups.

**Conclusions:** Providing a warning prior to administration of effort tests may decrease the face validity of these measures. The role-playing of the early CBIS-group appears to be important as face validity was not affected in the early-Control group.

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#### D. WHITESIDE, A. ZIMBEROFF, C. WHITE, J. STROEMEL, C. DIAMONTI, C. CLINTON & D. WATERS. The Relationship Between the Personality Assessment Inventory Clinical Scales and the Test of Memory Malingering in a Mixed Clinical Sample.

**Objective:** Previous research (Temple, McBride, Horner, & Taylor, 2003) explored the relationship between the Minnesota Multiphasic Personality Inventory-2 (MMPI-2) clinical scales and cognitive effort measures and found a relationship with suboptimal performance on a cognitive effort measure, the Portland Digit Recognition Test (PDRT). Other research (Whiteside, Dunbar-Mayer, & Waters, 2008) found a relationship between PAI validity scales and the Test of Memory Malingering (TOMM). The current study extended this research by evaluating the relationship between the Personality Assessment Inventory (PAI) clinical scales and the TOMM.

**Participants and Methods:** Data was collected from 22 consecutive clients referred for comprehensive outpatient neuropsychological evaluation who received both the TOMM and the PAI.

**Results:** Initial analysis was conducted with a factor score comprising the three TOMM variables (Trial 1, Trial 2, and the Retention Trial), named the TOMM Component Scale (TCS). With statistical correction for multiple comparisons, the TCS correlated significantly with the SOM ( $r = -.29$ ,  $p < .001$ ), DEP ( $r = -.23$ ,  $p < .001$ ), and SCZ ( $r = -.24$ ,  $p < .001$ ) scales, with additional scales (ANX, ARD, PAR, SUL, and NON) trending toward significance. Subsequent multiple regression analysis found a small but significant predictive relationship between the TCS and the SOM scale, but DEP and SCZ did not add significant variance once SOM was accounted for in the analysis. Further analysis found that of the SOM component subscales, only the SOM-C subscale significantly predicted TCS scores.

**Conclusions:** These findings provide evidence that individuals with somatic preoccupations, particularly related to conversion disorder symptoms, are most likely to demonstrate suboptimal effort on neurocognitive measures. Correspondence: *Douglas Whiteside, Ph.D., Clinical Psychology, Argosy University, Seattle, 2601-A Elliott Avenue, Seattle, WA 98121. E-mail: dwhiteside@argosy.edu*

#### D. ZAMORA, C. MICHAELS & P.J. DONOVICK. Ethnicity and the Prevalence of Learning Disabilities in an Incarcerated Sample.

**Objective:** Verbal disabilities are common in prisoners. This pattern of learning disabilities and lower levels of intelligence has been attributed to disparities in demographic variables like education and ethnicity. We determined if there were IQ differences among groups and if verbal disabilities were more frequent than nonverbal disabilities despite ethnic differences.

**Participants and Methods:** 235 archival files of male prisoners referred for neuropsychological testing were reviewed. 93 were classified as having a learning disability and were included in the study. The sample was divided into three ethnic groups including 34 Caucasians, 46 African Americans, and 13 Hispanics. Regardless of group, the sample did not differ in age or education. We examined differences between the groups in verbal and nonverbal IQ. The prevalence of verbal compared to nonverbal disabilities was also determined for each group.

**Results:** Of the 235 files reviewed, 40% were classified as having a learning disability of which 60.2% had verbal disabilities and 39.8% had nonverbal disabilities. Significant differences were found between the ethnic groups in verbal and nonverbal IQ. Caucasians had higher verbal and nonverbal IQ's, followed by African Americans, and then Hispanics. Regardless of ethnicity, all groups had a higher prevalence of verbal than nonverbal disabilities.

**Conclusions:** Caucasian individuals had a higher verbal and nonverbal IQ than the other ethnic groups. Compared to non-incarcerated individuals, prisoners consistently showed a higher prevalence of verbal than nonverbal disabilities regardless of ethnicity. A higher prevalence of verbal disabilities may be attributed to being incarcerated and not necessarily be influenced by ethnicity.

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### Hemispheric Asymmetry/Laterality/Callosal Studies

#### K.M. HARRELL, E. MARCO, L.K. PAUL, E. SHERR & W.S. BROWN. Proverb Comprehension in Individuals with Agenesis of the Corpus Callosum.

**Objective:** Although many individuals with agenesis of the corpus callosum (ACC) perform normally on measures of general intelligence, deficits have been noted in tests of fluid intelligence. Noteworthy are impairments in comprehension of second-order meanings in language, including nonliteral expressions and proverbs (Paul et al., 2003; Brown et al., 2005a) and humor (Brown et al., 2005b), and deficiencies in social comprehension in TAT pictures (Paul et al., 2004). This research replicated findings of deficient proverb interpretation using a different measure (proverbs subtest of the Delis-Kaplan Executive Function System) and a larger participant group.

**Participants and Methods:** Participants ( $N=17$ ; age  $M=31.18$ ,  $SD=11.02$ ) with complete or partial ACC ( $FSIQ > 80$ ) were administered the proverbs subtest which includes both free interpretation of common and unfamiliar proverbs, and recognition of the correct interpretation using a multiple choice format. All scores, including FSIQ ( $100.12 \pm 14.26$ ), were converted to standard scores for statistical comparisons.

**Results:** Individuals with ACC scored significantly lower than test norms on both free interpretation ( $t = -2.72$ ,  $p < .02$ ) and multiple choice ( $t = -1.90$ ,  $p < .02$ ). Scores for the free interpretation ( $-0.76 \pm 1.16$ ) and multiple choice ( $-1.90 \pm 2.68$ ) were also significantly lower than what would be predicted by their FSIQ ( $t = 4.37$  and  $t = 3.36$ ,  $p < .01$ , respectively).

**Conclusions:** This research supports previous findings that individuals with ACC have deficits in their understanding of the second-order meaning of non-literal, metaphoric, and proverbial language beyond that predicted by their overall intellectual functioning.

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#### R.D. WHITMAN, E. HOLCOMB, Z. WANG, J. FU LIAO, L. WURM & S. VANDYKE. Chinese and English Language Processing: A Lateralized Lexical Decision Study.

**Objective:** Research suggests that Asian populations have a neural organization of language processing that differs from Westerners. Semantic priming studies reveal equivalent lexicons in the right and left hemi-

spheres; the right hemisphere more diffusely organized than the left. We examined differences in priming using Chinese and English words in an Asian population with English as a second language. We proposed that Chinese characters, which are pictographic, will more strongly prime the right hemisphere; and that cross language priming would be greater from the left to the right hemisphere.

**Participants and Methods:** Subjects fluent in Mandarin Chinese and English were presented, in the right or left VFs, English or Chinese prime words followed by an English target word (SOA = 400) or a pronounceable nonsense word

**Results:** ANCOVAs analyzing the reaction time and error data showed significant effects for prime language, side of prime and association strength. Also English primes were more effective than Chinese at priming English targets. High associate primes were more effective than low associates. The right hemisphere ipsilateral priming was more effective than left hemisphere priming. Cross priming from left to right hemisphere was stronger than cross-priming from right to left hemisphere.

**Conclusions:** This is the first study to employ cross language priming with Chinese characters in Native Chinese-speaking subjects. Greater activation of the right hemisphere by Chinese characters suggests a different organization of language across hemispheres in this bilingual population.

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#### S.N. LEGARDY, L.K. PAUL & W.S. BROWN. Longitudinal Case Study of Agenesis of the Corpus Callosum: Child to Adult.

**Objective:** While IQ can be normal in agenesis of the corpus callosum (ACC), deficits have been observed in interhemispheric transfer, bimanual coordination, complex novel problem solving, comprehension of second-order meaning in language, and psychosocial comprehension. Some information is available on the emergence of these deficits in childhood, but nothing is known of the stability of the cognitive profile from childhood into adulthood.

**Participants and Methods:** This study involved a comprehensive neuropsychological battery given to a right-handed female with ACC at ages 12 and 21. She was diagnosed as an infant with no other known neurological disorders.

**Results:** While VIQ remained stable (T1 = 99; T2 = 104), she showed significant improvement in PIQ (71 versus 100). Scale score gains were noted in comprehension (+3), block design (+9), picture completion (+2), and picture arrangement (+6). Decline in performance (relative to controls) was seen on tasks demanding problem solving: Standard Ravens Progressive Matrices (50 to 25 percentile); Categories Test (82 to 6 percentile); and Wisconsin Card Sorting errors (84 to 68 percentile). On the Wide Range Achievement Test, spelling remained constant while arithmetic (58 to 18 percentile) and reading (77 to 61 percentile) declined. Performance on comprehension of nonliteral language was normal at both testings. Deficits on the Trail Making Test at first testing (A & B < 1 percentile) improved significantly (37 and 25 percentile, respectively).

**Conclusions:** This child-to-adult retesting of an individual with ACC indicated improvement (relative to norms) in performance skills, relatively stable verbal ability, and some decline on tests demanding complex novel problem solving.

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#### D.L. MCCABE, J.C. BOROD, K. ROGERS, J. LANOU, M. FRANK, P. EKMAN, M. MNEIMNE, K. ALTERESCU, A. GOLD, P. GROSSMAN & K. SCORPIO. The Effect of Laterality, Emotional Processing, and Spatial Positioning on Deception Detection.

**Objective:** Research demonstrates a right-hemisphere bias in processing facial emotion and spatial information and in detecting deception. We examined whether right-handed individuals were better able to detect deception in the left as compared to the right hemisphere or center of space, as well as the effects of emotional and spatial processing on deception detection ability.

**Participants and Methods:** Using a free-field viewing paradigm, healthy adults (n=122) viewed 10 mock-crime scenarios (Frank & Ekman, 1997) presented to their left, center, or right. Hemisphere biases for emotional (Chimeric Faces Task [CFT; Levy et al., 1983]) and spatial processing (Greyscales Task [Nicholls et al., 1999]) were determined.

**Results:** An ANOVA (Viewing Condition [3] x Gender [2]) revealed no significant Condition effect on deception detection accuracy but did reveal a significant Gender effect (p=.05), with women more accurate than men. A Viewing Condition (3) by CFT Quartile (2: Upper, Lower) ANOVA revealed an interaction (p=.086) in the predicted direction. A left hemisphere bias in emotional processing tended to be associated with increased detection accuracy within the left-viewing condition. A similar analysis for the Greyscales Task did not yield significant effects. As would be expected, there was a significant left hemisphere bias (p<.001) for both the CFT and Greyscales Task.

**Conclusions:** A trend-level interaction revealed increased deception detection accuracy in left-sided viewing by individuals with a strong left hemisphere bias for processing facial emotion. As crime-scenarios featured only men, the higher accuracy of women participants is consistent with a previously observed opposite-sex advantage in deception detection (e.g., Porter et al., 2002).

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#### M. PACHALSKA, B.D. MACQUEEN, B. LUKASZEWSKA & A. PUFAL. Hyperverbalization in Patients with Right-Hemisphere Brain Damage: Three Cases.

**Objective:** Among the salient features of drawings made by RHD patients is unprompted labeling and written commentaries on drawings. The proposed paper will present this phenomenon (often observed but seldom studied) in several variants, with material from three patients, including two professional artists.

**Participants and Methods:** Patient 1, a 60-year-old right-handed farmer, suffered an ischemic RH stroke. Though he had never been an artist, he drew profusely in therapy, carefully labeling all elements without prompting, not infrequently in a ribald manner. Patient 2, a 61-year-old unemployed artist, right-handed, schizophrenic, suffered a TBI at age 61. He also began by labeling, but progressed to writing commentaries and explanations along the sides of his drawings. Patient no. 3, ambidextrous female, a prominent artist, suffered an RH stroke at age 62. At first she also labeled extensively, but the labels developed into commentaries, which evolved into longer texts illustrated by drawings. All three patients showed other common RHD symptoms, including hemispatial neglect, with some evident effects on the drawing.

**Results:** These three cases display a continuum, from the labeling seen in many RHD patients, through written commentaries, to an artistic fusion of illustration and text. The mechanism here surely involves the inability of the damaged right hemisphere to make sense of visual material, a deficit for which the left hemisphere compensates by verbalizing.

**Conclusions:** The dialectic between the iconic nature of the written word and the semantic content of drawings will be discussed in the light of microgenetic theory.

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#### S. SADLER, K.A. KAPLON & C.A. ABEARE. Interhemispheric Communication and Novel Solution Generation.

**Objective:** The purpose of the current study is to examine the relationship between interhemispheric communication and both figural and verbal solution generation in a group of right-handers. Interhemispheric communication was measured by reaction times to lateralized stimuli. It was predicted that those individuals with faster interhemispheric transfer times (IHTTs) would attain higher scores on the novel solution generation/creativity tasks.

**Participants and Methods:** Thirty right-handed participants completed the Poffenberger paradigm (Poffenberger, 1912), Verbal Form A (Torrance, 1990) and Streamlined Figural Form A (Torrance, 1992) of the Torrance Tests of Creative Thinking, which are designed to measure verbal and non-verbal aspects of creative/ novel solution generation ability, respectively.

**Results:** Results revealed that IHTTs were negatively correlated with both figural fluency scores and figural originality scores, while IHTTs were positively correlated with figural abstractness of titles scores.

**Conclusions:** The results of the present study partially supported the prediction that IHTTs would be correlated with creativity scores. This reveals that interhemispheric communication is related to the production of non-verbal novel/creative responses, but is not related to the production of verbal solution generation in right-handed individuals.

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#### R.D. WHITMAN, E. HOLCOMB & C. STANO. Laterlization Of The Remember Know Paradigm: What's Right Is Known And What's Left Is Remembered.

**Objective:** The Remember-Know paradigm involves presentation of a list of words followed by a recognition task which including old words, new words, and semantically related new words. Ss are asked to label words as "old" or "new" and "remembered" or "know." We hypothesized that both the "know" experience and false memories occur more after right hemisphere (RH) priming with semantically related word lists.

**Participants and Methods:** Participants were 75 native English speaking right handed undergraduates with normal vision or corrected vision and no history of head injury, psychotropic medication, or stroke with at least an 8th grade reading level. The experiment consisted of a lateralized lexical decision task (200 ms. SOA) during which different hemispheres received a cluster of semantically related words followed by an Immediate and a Delayed Recognition task using the standard "remember-know" procedure.

**Results:** Subjects produced significantly more false recognition "know" responses than false recognition "remember" responses to lure words (related to previously primed words) from lists presented to the right hemisphere; this is consistent with our prediction that the right hemisphere does not require as great an activation of the semantic network or "rich recollective details" to produce a false recognition. A significant reduction in "false know" responses after a delay suggested a reduction in lexical activation.

**Conclusions:** We confirmed that stimuli presented to the right hemisphere would activate a broader range of associations creating a greater sense of familiarity and leading to a greater proportion of "know" responses and errors (false memories).

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#### Other

#### M.A. LAWRENCE, G. ESKEs & R.M. KLEIN. Measuring the Components of Attention with the Attention Network Test: Is it Reliable?

**Objective:** The Attention Network Test (ANT) was designed to measure the integrity of three different components (networks) of attention (orienting, alertness and cognitive control). The ANT (and modified versions) is an easily administered reaction time (RT) task, requiring only 30 minutes and available for populations across all age ranges. It has been widely adopted for testing attention in normal and clinical populations, including those with developmental disorders, acquired brain injury, schizophrenia, borderline personality disorder and geriatric depression. While RT measures are sensitive to changes in cognitive processes, valid interpretation of differences in RT between tasks and between populations depends upon the underlying reliability of the measures obtained. Thus, the purpose of our study was to examine the reliability of the measures of different components of attention obtained from the ANT in children and adults.

**Participants and Methods:** Data were obtained from published and unpublished studies that administered the ANT to non-clinical populations, including 6 adult studies (total of 476 participants) and 3 child studies (total of 204 participants).

**Results:** Reliability estimates for the alerting and orienting components were variable and low (weighted means = 0.35, 0.27, respectively), while reliability estimates of the cognitive control component were consistently high (weighted mean = 0.75).

**Conclusions:** Interpretation of group or individual differences in the three components is challenging, given the differences in reliability of the component scores. While changes in cognitive control appear the most reliable and ubiquitous finding in many clinical populations, findings regarding the alerting and orienting component scores may be an artifact of the differential power of the ANT to measure these networks.

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#### Stroke/Aneurysm

#### K.H. DEMERTZIS, B.K. RUSH, C. BOWERS, R.B. MCNEIL, O. PEDRAZA, D.M. GAMBLE, S.H. LUKE, A.N. RICHIE, T.G. BROTT & J.F. MESCHIA. Diagnostic Validity and Clinical Utility of the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) in Acute Stroke.

**Objective:** To evaluate the diagnostic validity and clinical utility of RBANS subtests in acute stroke survivors.

**Participants and Methods:** Forty-two cases of ischemic stroke (57% male; mean age, 67 years; education, 13 years), and 53 stroke-free controls (40% male; mean age, 64 years; education, 16 years) completed the RBANS, FAQ, and IQCODE-SF. Cases averaged 33 days (SD 6.7) following stroke onset. Mean NIH Stroke Scale was 2.9 (SD 3.5) at stroke onset and 2.0 (SD 2.7) at test completion. Group differences were evaluated using linear regression adjusting for age, IQCODE-SF, and education. Diagnostic validity and clinical utility indicators were calculated for RBANS subtests, with rates of cognitive impairment examined across candidate cutoff values of -1.0, -1.5, and -2.0 SDs for each subtest.

**Results:** Raw score analyses revealed that, compared to controls, cases were rated as more functionally impaired on the FAQ and IQCODE-SF, and scored lower on Coding, List Learning, List Recall, and List Recognition RBANS subtests ( $p < 0.01$ ). Across RBANS subtests and cognitive impairment cutoffs, sensitivity ranged from 0.07 to 0.60, specificity from 0.75 to 1.00, and hit rate from 0.57 to 0.74. Likelihood ratios ranged from 1.5 to 36.4, positive predictive value from 0.50 to 1.00, and negative predictive value from 0.57 to 0.73. Coding provided the best diagnostic accuracy and clinical utility regardless of the cognitive impairment criterion selected.

**Conclusions:** RBANS subtests may have limited diagnostic validity or clinical utility in acute, mild stroke patients with observable functional impairments. Implications for clinical practice and research in stroke are discussed. Correspondence: Kristen H. Demertzis, PhD, Psychology/Psychiatry, Mayo Clinic, 7651 Gate Parkway, apt. 2209, Jacksonville, FL 32256. E-mail: demertzis.kristen@mayo.edu

#### Paper Session 12: Assessment

10:00–11:30 a.m.

#### R.M. BILDER, F.W. SABB & R.A. POLDRACK. Neuropsychology 2.0: Leveraging Genomics, Phenomics, and the World Wide Web.

**Objective:** This presentation aims to promote innovation in neuropsychology by identifying a series of proposals for development, paralleling the emergence of "Web 2.0" technologies that have witnessed the explosion of social collaborative networking and web-based data acquisition in other research and clinical disciplines.

**Participants and Methods:** Not applicable

**Results:** Not applicable

**Conclusions:** Neuropsychology (NP) is increasingly limited by current conceptual models and inertia in assessment methods. Classical NP “domains” fail to reflect discoveries in cognitive neuroscience and fail to reflect current clinical needs. Clinical NP also suffers “instrumentation inertia” tied to print publishing, protracted revision cycles and static administration formats. To advance research and practice in neuropsychology, proposals include:

- (1) Cognitive ontology collaborations: collaborative networks can specify new construct models, along with relevant arguments and evidence, and help advance definition of constructs most relevant in specific clinical and research contexts;
- (2) Collaborative knowledge-bases: to overcome instrumentation inertia caused by static normative and “validity” data, data repositories could support rapid aggregation of clinical knowledge and support covariance structure analysis among measures;
- (3) Open-source instrumentation and item banks: web-based, computerized adaptive testing, and dynamic modification of test contents based on emerging data and construct redefinitions from linked knowledge-bases, can dramatically decrease revision time and enable evolution of new construct definitions using modern psychometric theory.

The action plan proposed above could help advance research integrating neuropsychology with neuroimaging and genetic studies, and enable clinical neuropsychology to evolve into a more dynamic phase that is integrated with medical informatics strategies of the future.

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**M. SCHMITTER-EDGECOMBE, C. SANDERS, L. ANDERSH & D.J. COOK. Profiling Activities Of Daily Living Using Pervasive Sensing In A Smart Environment.**

**Objective:** This study utilizes pervasive sensing technologies in a smart apartment at Washington State University to determine whether software algorithms can recognize and detect errors in the completion of activities of daily living (ADLs).

**Participants and Methods:** Sixty undergraduate students performed scripted ADLs that involved telephone use, hand washing, meal preparation, eating and medication use, and cleaning. Twenty participants completed the ADLs normally (normal group), 20 participants performed a scripted error during completion of each ADL (e.g., leave burner on), and 20 participants were provided with general descriptions of task completion errors for each ADL (e.g., simulate someone having difficulty with the timing and order of the steps) and generated their own error to perform. Sensors readings were obtained from motion, temperature, water, burner, and phone usage sensors.

**Results:** Using 3-fold cross validation on the activity traces from the normal group, a Markov model (MM) achieved 98% classification accuracy. The MM learned from the normal group was then used to generate an anomaly detection algorithm. We validated this algorithm by processing each activity in the error datasets and reporting the skipped step as missing if an error was detected by the algorithm. Our results demonstrated that the algorithm not only recognizes activities but also assesses the completeness and accuracy of the performed activity using anomaly detection.

**Conclusions:** As a first step in developing at-home technologies for automated assistance and health monitoring, our research illustrates that profiles of ADLs can be learned from sensor events collected by a smart environment.

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**M.H. KOSMIDIS, E. ARETOULI & A. MALEGIANAKI. Establishing the Cultural (in-)Appropriateness of Neuropsychological Tests.**

**Objective:** In a recent attempt to develop normative data for a widely-used neuropsychological test in Greece, namely, the Wisconsin Card Sorting Test (WCST), we discovered that it underestimated cognitive functions in the Greek population. We tested the hypothesis that certain requirements of this task made it challenging to healthy Greek adults by isolating some of the cognitive components assessed by the WCST (i.e., conceptualization, categorization, use of feedback, shifting, perseveration, strategy formation in the absence of explicit instructions).

**Participants and Methods:** Thus, we administered the WCST along with selected tests [i.e., Color-form Test, Category Test (subtests I-IV), 20-Questions Test] to assess these components in a new sample of healthy adults.

**Results:** Our preliminary findings indicated that, despite poor overall WCST performance, our sample was capable of conceptualizing and categorizing information, and demonstrated adequate cognitive flexibility; thus, our participants were not impaired. In contrast, when faced with a simple test requiring strategy formation in the absence of explicit instructions, our sample of healthy adults did not use strategies systematically.

**Conclusions:** These findings support our previous suggestion that educational emphasis on convergent vs. divergent thinking may play a role in poor WCST performance, making this test a poor tool for assessing executive functioning in the Greek population.

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**L.K. AYR, N. ULLRICH, E. LEAFFER & C. REY-CASSERLY. Feasibility of a Virtual Analogue of the Morris Water Maze to Assess Spatial Learning in Children and Adolescents with Neurofibromatosis Type 1.**

**Objective:** To assess the feasibility of a virtual analogue of the Morris Water Maze in children with neurofibromatosis type 1 (NF1). In NF1 animal models, the water maze is sensitive to spatial learning deficits, hypothesized to result from the effects of impaired neurofibromin on Ras activity. A behavioral index targeting visual spatial learning deficits in children with NF1 has potential implications for the development of clinical trials and therapeutic innovations.

**Participants and Methods:** Ten patients with NF1, age 10 to 16 (mean 12.8 years), were recruited for this study. They completed a computerized task of spatial learning, the Computer-Generated Arena (CG-Arena) which requires finding a hidden platform over several learning trials. On the last trial, the platform is removed without the participant’s knowledge. Measures of spatial learning include time to target across trials and percent of total time spent in correct quadrant on last trial.

**Results:** Participants took less than 10 minutes to successfully find the hidden platforms, spending an average of 66 % of the time in the correct quadrant on the last trial. Two patterns of performance were identified: short latencies on all trials; and long latencies on the first learning trial with substantially reduced time to target over subsequent trials.

**Conclusions:** Children and adolescents with NF1 are able to complete a computerized visual spatial learning task and demonstrate learning over trials. Normative data from children without visual spatial difficulties are being collected to explore specific patterns of performance and address issues of task difficulty and sensitivity.

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**M. VAN TUBBERGEN, S. WARSCHAUSKY, S. ASBELL, J. KAUFMAN, J. DONDERS & R. AYYANGAR. Psychometrics of Neuropsychological Measures Modified for Use with Assistive Technology in Children with and without Cerebral Palsy.**

**Objective:** To examine the psychometric properties of neuropsychological measures and procedures modified for use with assistive technology in children with and without cerebral palsy.

**Participants and Methods:** Participants were 24 children with cerebral palsy (CP) aged 6-11 years matched with typically developing (TD) peers on age (mean 9.6, SD=1.7), gender (56.3% female) and verbal intellect (SS mean 104.2, SD=11.7). Instruments were the Peabody Picture Vocabulary Test – III, Ravens' Coloured Progressive Matrices (CPM), Comprehensive Test of Phonological Processing (CTOPP) Elision subtest and Peabody Individual Achievement Test – Revised Reading Comprehension subtest. Standardized and modified test administration was in counterbalanced order. Modifications included computerized presentation and response using an assistive technology (AT) device (pressure switch or Headmouse). Participants were randomly assigned to an AT device.

**Results:** Intraclass correlations (ICCs) for standard and adapted tests were adequate for all tests in the CP group (ICC = .74-.95). In the TD group, ICCs were inadequate for the Raven's CPM, ICC = .44, and CTOPP Elision, ICC = .34. A significant main effect for group was noted in CTOPP Elision scores, only. The main effect for AT device and Group X AT device interaction was not significant.

**Conclusions:** Preliminary psychometric evidence suggests that some modified neuropsychological instruments and procedures yield adequate measurement agreement in children with CP. Type of AT access did not differentially affect performance on target instruments. Challenges remain in developing visual forced choice format measures of phonemic awareness.

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## Paper Session 13: Psychopathology/Neuropsychiatry: Depression

10:45 a.m.–12:15 p.m.

**S.M. MCCLINTOCK, M. CULLUM, M.M. HUSAIN, C.H. SILVER, B. KENNARD, C. HUGHES, J. SHAW, R.G. KNAPP, M. MUELLER, G. PETRIDES, S. SAMPSON & C.H. KELLNER. Global Cognitive and Memory Function in Severe Depression.**

**Objective:** Major Depressive Disorder (MDD) is believed to negatively impact cognitive function. However, there has been limited examination of the relationship between neurocognitive functioning and depressive characteristics. This study examined the association between depression severity, global cognitive function and memory in patients with severe, treatment-resistant depression.

**Participants and Methods:** 66 subjects with DSM-IV, SCID-I diagnosed MDD were enrolled in a multicenter-trial to assess the efficacy and neurocognitive effects of electroconvulsive therapy. Depression severity was measured by the 24-item Hamilton Rating Scale for Depression (HRSD24). Neuropsychological measures included the MMSE, Rey Auditory Verbal Learning Test (RAVLT), and the Rey-Osterrieth or Taylor Complex Figure Test (CFT). Raw scores were converted to demographic-corrected T-scores. Correlational and regression analyses were computed to explore associations between depression severity and cognitive function.

**Results:** The mean age was 53.6 years (SD=15.8), education was 14.3 years (SD=2.6), 65% were female, and mean HRSD24 was 33.9 (SD=6.7). Mean T-scores were in the average to borderline range. The mean T-score for the MMSE was 44.0 (SD=12.6), RAVLT immediate recall =45.4 (SD=11.9), delayed recall =41.3 (SD=12.8), and CFT immediate recall =42.4 (SD=14.2) and delayed recall =40.0 (SD=13.3). Depression severity was unrelated to performance on the MMSE ( $R^2=.05$ ,  $p=.07$ ), RAVLT immediate ( $R^2=.01$ ,  $p=.41$ ) or delayed recall ( $R^2=.02$ ,  $p=.30$ ), or CFT immediate ( $R^2=.05$ ,  $p=.16$ ) or delayed recall ( $R^2=.00$ ,  $p=.95$ ).

**Conclusions:** In this sample of severely depressed subjects referred for ECT, depression severity was unrelated to cognitive function. This suggests that depressive episode severity may not be systematically related to the cognitive difficulties seen in these patients with severe MDD. Future research should examine the interactions between other clinical characteristics and neurocognitive function in patients with depression. Correspondence: *Shawn M. McClintock, Ph.D., Psychiatry, UT Southwestern Medical Center, 5323 Harry Hines Blvd., Dallas, TX 75235-8898. E-mail: shawn.mcclintock@utsouthwestern.edu*

**T. PATERSON, S. GELB, R.J. SHAPIRO & W.J. THORNTON. Self-reported Depressive Symptoms Mediate the Relationship Between Cognition and Medication Adherence in Renal Transplant Patients.**

**Objective:** Our lab has previously reported diminished cognitive functioning following successful renal transplant, which may have implications for illness management; specifically, medication adherence. However, these implications as well as the impact of potential modifiers of cognitive performance following transplant remains unknown. In the current study, we assessed the relationship between cognition, depression, and medication adherence in renal transplant patients. Specifically, we examined whether scores on the CES-D Somatic Symptoms factor mediated the relationship between cognition and adherence.

**Participants and Methods:** Renal transplant patients (N=101) completed a cognitive battery, the CES-D, and Transplant Effects Questionnaire (TxEQ), which assesses behavioral/emotional responses following transplantation. Using a product-of-coefficients method (Sobel-type test), we examined the relationship between cognition (using a PCA derived component-score), the CES-D Somatic Symptoms factor, and adherence (TxEQ reported).

**Results:** Weaker cognitive performance was associated with reduced adherence, decreased cognitive ability significantly predicted somatic symptomatology, and participants endorsing increased somatic depressive symptoms endorsed decreased adherence (all  $p$ 's < .05). The CES-D Somatic Symptoms factor score significantly mediated the relationship between cognition and TxEQ Adherence scores (Sobel's  $Z = p < .05$ ). Age, gender, and education were not significantly associated with TxEQ Adherence scores.

**Conclusions:** Cognition and somatic symptoms of depression are important modifiers of medication adherence in renal transplant patients. Results show that the CES-D Somatic Symptoms factor (containing five questions) mediates the relationship between cognition and medication adherence in this population, indicating its potential utility as a brief screening measure in addition to cognitive assessment for renal transplant patients.

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**V. DOTSON, A.B. ZONDERMAN, C. DAVATZIKOS, M.A. KRAUT & S.M. RESNICK. Cognitive Functioning, Brain Volumes, and a History of Elevated Depressive Symptoms: Effects of Age and Sex.**

**Objective:** Depressive disorders are associated with alterations in frontolimbic regions of the brain and with deficits in memory, attention, and executive functions. Previous research suggests that the relationship between depressive symptoms (DS) and cognitive and neural outcomes is greater in men than in women. This longitudinal study investigated associations between a history of elevated DS, brain volumes, and cognitive functioning and examined whether the associations varied as a function of age and sex.

**Participants and Methods:** 689 dementia-free adults 50 years of age and older from the Baltimore Longitudinal Study of Aging (BLSA) underwent cognitive evaluation at 1-2 year intervals for up to 26 years. A subset of 106 participants also received magnetic resonance imaging scans for up to 9 years. DS were measured at each visit using the Center for Epidemiologic Studies Depression Scale (CES-D).

**Results:** A history of elevated DS (CES-D score of 16 or higher) was associated with attentional deficits at older ages in men, but not in

women. DS were also associated with smaller total gray matter volumes and smaller regional volumes in left frontal and right temporal gray matter at older ages. Men, but not women, had smaller left temporal gray matter volumes as a function of DS. Moreover, individuals with a history of elevated DS showed a faster rate of ventricular enlargement.

**Conclusions:** A history of elevated DS is associated with cognitive deficits and volume reductions in specific brain regions, particularly with advancing age. These associations are especially prominent for men compared to women.

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**M.R. BASSO, D. COMBS, R. PURDIE & R.A. BORNSTEIN. Criterion Validity of the Cognitive Complaints Scale from the MMPI-RF in Inpatients with Major Depression.**

**Objective:** Cognitive impairment occurs in some people with major depression, but factors predicting impairment are poorly understood. Some investigators have examined whether self-reported complaints of distress correspond with impairment, and have yielded mixed results. The MMPI-RF includes newly developed scales, some of which address self-reported cognitive complaints. The present study examined the criterion validity of the Cognitive Complaints scale (CC) in a sample of inpatient depressives.

**Participants and Methods:** Inpatients with no history of neurological illness participated. 96 were diagnosed with major depression and 32 were diagnosed with major depression with psychotic features. Diagnoses were made by boarded psychiatrists at a teaching hospital. A control group of 17 individuals also participated.

Patients were administered digit span, California Verbal Learning Test (CVLT), COWAT, Trailmaking Tests A & B, and the grooved pegboard test (dexterity). Additionally, to assess severity of psychiatric symptomatology, the MMPI-RF was administered. All tests were administered according to standardization instructions.

**Results:** Neuropsychological test scores were regressed upon age, education, sex, and the CC scale. Additionally, impact of overall emotional distress was examined by entering the Demoralization scale. The CC scale emerged as a significant predictor of impairment across the battery (semi-partial corrs = .2-.3), but Demoralization did not.

**Conclusions:** The CC scale demonstrated convincing criterion validity, thereby recommending its potential use in screening patients who might benefit from a neuropsychological examination. These data suggest that patient complaints of neurocognitive dysfunction may possess merit, and should receive attention. These findings accord well with an emerging literature concerning cognitive impairment in major depression.

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**S.M. MCCLINTOCK, M. CULLUM, B. LUBER, B. ADAMS-HUET, M.M. HUSAIN & S.H. LISANBY. Magnetic Seizure Therapy: Neurocognitive Effects of Different Stimulating Coil Orientations.**

**Objective:** Magnetic Seizure Therapy (MST) is a novel neurostimulation therapy under development to treat severe, major depressive disorder (MDD). With MST, the induced electric field and resultant seizure is more cortically focused and spreads less to deeper brain structures than with electroconvulsive therapy. This focality is hypothesized to reduce cognitive side effects. This is the first study to systematically examine the acute neurocognitive effects of a full MST course and to explore whether MST coil orientation affects cognitive outcome.

**Participants and Methods:** Twenty patients with DSM-IV diagnosed severe MDD received MST with different coil orientations: round, double-cone, or cap. Time to orientation and neuropsychological measures of visual attention, verbal fluency, and sentence recognition were obtained. Mixed-model analyses were computed to compare the neurocognitive effects of treatment course and coil orientation.

**Results:** The mean age of the sample was 46.7 years (SD=9.9), education 17.0 years (SD=1.0), and 55% were male. No significant difference in time to orientation or neurocognitive performance was found over the MST course. Although the double-cone coil resulted in shorter time to orientation (149.5sec) relative to the round (184.9sec) or cap (195.0sec) coil, this difference was nonsignificant. Also, performance on visual attention ((syllable cancellation ( $F=.051$ ,  $p=.61$ ), geometric shape cancellation ( $F=3.0$ ,  $p=.07$ ), nonsense shape cancellation ( $F=1.1$ ,  $p=.37$ )), letter and category fluency ( $F=0.24$ ,  $p=.79$ ,  $F=0.05$ ,  $p=.95$ ; respectively), and sentence recognition ( $F=2.44$ ,  $p=.12$ ) was unrelated to coil orientation.

**Conclusions:** Based on these preliminary analyses, neurocognitive function was not-affected by MST course or coil orientation. Specifically, time to orientation and performance on visual attention, verbal fluency, and sentence recognition measures were unrelated to MST treatment course or coil orientation. Further investigation of MST parameters is warranted to replicate these findings.

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**Invited Symposium:  
Neurologic Perspectives on White Matter**

**Chair: Christopher Filley**

**10:45 a.m.–12:15 p.m.**

**C.M. FILLEY. Neurologic Perspectives on White Matter.**

**Symposium Description:** Although neurologists have long recognized that white matter is critical for motor and sensory function, the behavioral neurology of white matter has attracted much recent interest. About half the brain volume is white matter, and myelinated systems course throughout the brain to integrate cortical and subcortical gray matter structures into functional ensembles that subservise all aspects of cognition and emotion. In health, white matter plays a central role in information transfer, complementing the information processing that occurs within gray matter. When neuropathological lesions damage white matter, brain-behavior relationships may be dramatically altered, leading to focal neurobehavioral syndromes, neuropsychiatric conditions, and cognitive dysfunction often severe enough to qualify as white matter dementia. In this symposium, the normal white matter will be discussed in light of recent neuroanatomical advances, and selected disorders of white matter will be considered to illustrate the crucial role of white matter in behavior across the life span. Dr. Schmahmann will first explore the neuroanatomy of white matter by presenting new observations and insights based on elegant animal studies. Dr. Kelly will next take up the area of traumatic brain injury, in which diffuse axonal injury within the white matter is a prominent neuropathological feature and an important determinant of neurobehavioral impairment in young people who are most at risk for this injury. Dr. Smith will then address the topic of vascular white matter disease, a common and multifaceted problem in older adults that is increasingly seen as a major factor in the emerging epidemic of dementia. Dr. Filley will summarize the session and provide an overview of the field, including a discussion of how neuropsychological assessment is essential for investigating how white matter contributes to the distributed neural networks by which higher functions are organized.

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**J.D. SCHMAHMANN. Cerebral White Matter Pathways – Neuroanatomy and Principles of Organization.**

**Objective:** Neurological function is subserved by distributed neural circuits comprising geographically dispersed cortical and subcortical nodes



that interact in concert to support sensorimotor function, cognition, and emotion. The critical elements that link these nodes are the cerebral white matter pathways. There is a General Principle of cerebral organization that five groups of efferent fibers emanate from every cortical area and are directed with topographic precision via 1) association fibers to ipsilateral cortical areas; 2) striatal fibers to basal ganglia; 3) commissural fibers to contralateral cerebral regions; and projection subcortical bundles to 4) thalamus, and to 5) the pontocerebellar system, brain stem, and/or spinal cord. An overview of these fibers and their relevance for cognitive neuroscience and clinical disconnection syndromes will be presented, with particular emphasis on the long association pathways – the superior longitudinal fasciculus subcomponents I, II, and III; the cingulum bundle; uncinate fasciculus; fronto-occipital fasciculus, inferior longitudinal fasciculus; extreme capsule; arcuate fasciculus; and middle longitudinal fasciculus. The connections conveyed by these fiber tracts are precisely ordered, and cortical areas can essentially be defined by their patterns of subcortical and cortical connections. We will conclude with our proposed Specific Principle of cerebral organization that neural architecture determines function, i.e., each architectonically distinct cortical and subcortical area contributes a unique transform, or computation, to information processing; the anatomically precise and segregated connections conveyed by the white matter tracts between nodes define behavior; and association fiber tracts that link cerebral cortical areas with each other enable cross-modal integration required for evolved complex behaviors.

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#### **J.P. KELLY. White Matter Lesions of Traumatic Brain Injury.**

**Objective:** Diffuse axonal injury, the lasting neuronal lesion of traumatic brain injury, is the result of axonal disruption within white matter tracts due to tissue strains of shearing forces. Adjacent brain regions of different tissue densities or fiber tract orientations tend to move differentially, accounting for those locations being most frequently injured. Lesser forces register just below the cortex at the gray-white junction while stronger forces create lesions within the corpus callosum and deeper subcortical tracts, the most damaging of which affect the reticular activating system leading to prolonged unconsciousness. Neurobehavioral disorders are the frequent result since the frontal lobes are more commonly injured regardless of the direction of force. The cholinergic system, central to memory functions, is damaged out of pro-

portion to other neurotransmitter systems, suggesting that its unmyelinated fibers are more vulnerable to shearing forces than those of the dopamine or serotonin systems which are more heavily myelinated. Gradient echo MRI detects residual hemosiderin at the sites of petechial hemorrhage which are associated with areas of more widespread axonal injury in those regions – since cerebral vessels are more durable than axons, the presence of vascular injury is a certain marker for multifocal or diffuse axonal injury. Diffusion tensor imaging is a newer technique which impressively demonstrates loss of axonal integrity of deep white matter tracts resulting from TBI. The underlying electron microscopic “common denominator” of white matter injury, however, remains well below the threshold of even these highly sophisticated neuroimaging studies.

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#### **E.E. SMITH. White Matter Lesions: Implications for Age-Related Cognitive Decline and Dementia.**

**Objective:** White matter lesions in the brain become ubiquitous with aging and are readily detectable by MRI or CT. Epidemiologic studies performed over the last 10 years show that these lesions are associated with vascular risk factors. Healthy or mildly impaired persons with higher white matter lesion volume perform worse on neuropsychological testing than persons with lower white matter lesion volume. Executive function and psychomotor processing speed are most severely affected, but deficits in working memory and episodic memory are also described. Despite years of research, the pathophysiology of these lesions, and the degree to which they influence the risk of dementia, remain controversial. The state of the evidence linking age-related white matter lesions with vascular disease and cognition will be reviewed in this presentation. Topics to be discussed include: 1) the role of cerebral small vessel disease in causing age-related white matter lesions, 2) genetic investigations of white matter lesion burden, 3) neuroanatomic correlates between white matter lesion location and neuropsychological function, and 4) the relationship between white matter lesions and Alzheimer’s Disease. Current areas of controversy, and areas ripe for additional investigation, will be emphasized.

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### **SATURDAY AFTERNOON, FEBRUARY 14, 2009**

#### **Symposium 11: Complexities in Measuring Depression in Neurological Disorders: Are Neurovegetative Symptoms Valid?**

**Chair: Peter Arnett**

**Discussant: Joseph Beoney**

**12:30–2:00 p.m.**

**P. ARNETT, A.R. RABINOWITZ, J. BEENEY, F. BARWICK & L. STROBER. Complexities in Measuring Depression in Neurological Disorders: Are Neurovegetative Symptoms Valid?**

**Symposium Description:** A growing body of research has explored the validity of neurovegetative symptoms of depression in neurological disorders and medical disorders more broadly. A central issue that has emerged pertains to whether neurovegetative symptoms of depression truly reflect depression or are symptoms of disease. Fatigue,

concentration difficulties, sleep problems, and sexual dysfunction, among other symptoms, are neurovegetative symptoms of depression; however, they are also common symptoms of many neurological disorders. What do they reflect in such disorders? Using multiple sclerosis (MS) as a model, this symposium will present data that suggest that neurovegetative symptoms can simply reflect disease symptoms in MS, and contrasting data that indicate neurovegetative symptoms can reflect depression. Amanda Rabinowitz will discuss a factor analysis in a large sample of MS patients showing that neurovegetative depression symptoms reflect general fatigue and cognitive fatigue factors but not depression. Joseph Beoney will introduce a concept known as Emotional Reserve Capacity (ERC) as an organizing conceptual framework for describing how, when brain systems are disrupted in MS that simultaneously disrupt cognitive, emotional, physical and psychological functioning, depression is more likely. Fiona Barwick will show that, compared with patient ratings, significant other ratings of patient vegetative depression symptoms appear to be more associated with other core depression symptoms (i.e., mood) in MS patients, thus suggesting that vegetative depression symptoms may be interpreted differently in MS patients than significant others who

observe them. Lauren Strober will introduce an innovative method for evaluating whether neurovegetative depression symptoms reflect depression or MS symptoms in individual patients. A debate moderated by Peter Arnett will then ensue regarding the issues raised by the individual presentations.

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**P. ARNETT, A. RABINOWITZ & A. FISHER. Vegetative Symptoms of Depression and Fatigue in Multiple Sclerosis.**

**Objective:** In patients with MS, it is unclear whether vegetative depression symptoms are related to depression, or to other disease sequelae, like fatigue. In order to address this issue, the present study evaluated the relationship between the items of three measures commonly used in this patient population: two measures designed to assess fatigue, and one measure designed to assess three domains of depressive symptoms in chronic illness populations—mood, evaluative, and vegetative symptoms.

**Participants and Methods:** Using SPSS, an item-level principal component analysis was conducted on data from one-hundred and seventy-four MS patients. Entered into the analysis, were the items of the Fatigue Severity Scale (FSS), the Fatigue Impact Scale (FIS), and Chicago Multiscale Depression Inventory (CMDI). The rotation method selected was oblimin with Kaiser normalization.

**Results:** Eigenvalues, visible inspection of the scree plot, and theoretical considerations suggested a three-factor solution. Cumulatively, these three factors explained 46.7% of the variance. The first factor included 37 items related to physical and social symptoms of fatigue (general fatigue). The second factor included 34 items related to mood and evaluative symptoms of depression (depression). The final factor included 25 items related to cognitive symptoms (cognitive fatigue). Items from the CMDI vegetative depression scale loaded on the general fatigue and cognitive fatigue factors, but not the depression factor.

**Conclusions:** These results suggest that these self-report questionnaires measure three distinct constructs—general fatigue, cognitive fatigue, and depression. Furthermore, vegetative depression symptoms are more related to sequelae of MS—like fatigue and cognitive symptoms—than depression per se.

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**P. ARNETT, J. BEENEY & F. BARWICK. Emotion Reserve Capacity: When do Cognition and Emotion Overlap and does it Matter?**

**Objective:** Implicit within a discussion of symptom overlap between depression and multiple sclerosis (MS) disease symptoms, is the frequently difficult task of discerning physical, neurological, emotional and cognitive problems. In addition to briefly reviewing data from our lab concerning this issue, this talk will focus on instances of both overlap and the distinction between emotional, cognitive and psychological factors related to depression in MS. Important to this discussion will be instances in which neurological dysfunction may affect brain systems that affect both cognition and emotion simultaneously. The role of neuropsychological domains involved in emotion regulation will also be discussed. In anchoring this discussion, our lab's model of depression (Arnett, Barwick & Beeney, 2008) will be detailed and a new concept we call "emotion reserve capacity" (ERC), will be introduced as an organizing principle for the effects of various factors on emotion. Our model of depression proposes that neurological, cognitive, physical and psychological factors combine to predict depression in MS. Brain reserve capacity, from which we derived this new concept, ERC, is a theory that some individuals, due to numerous factors, demonstrate little functional impairment despite significant brain damage. ERC is a theory that some in-

dividuals, due to numerous factors, demonstrate little emotional disruption despite significant loss, stressors, physical impairment, and even brain damage. It will be argued that when brain systems are disrupted in MS that simultaneously disrupt cognitive, emotional, physical and psychological functioning, depression is more likely.

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**P. ARNETT & F. BARWICK. Patient and Significant Other Reports of Mood and Vegetative Depression Symptoms in MS.**

**Objective:** In neurological populations, it is unclear whether patient ratings of vegetative depression symptoms reflect depressed mood. This question was examined in patients with multiple sclerosis (MS) using both PT (PT) and significant other (SO) ratings of mood and vegetative depression symptoms.

**Participants and Methods:** As part of a larger neuropsychological evaluation, 101 MS patients were administered the Chicago Multiscale Depression Inventory (CMDI), which has subscales for mood, evaluative, and vegetative depression symptoms. SOs rated PTs on the CMDI. Correlations between PT- and SO-rated mood and vegetative symptoms were examined. High-low groups were created using both PT and SO vegetative symptom ratings, and these groups were compared on reported levels of mood symptoms.

**Results:** Correlations between SO ratings of patients' vegetative and mood symptoms were higher ( $r=.59$ ) than were correlations between PT ratings of their own vegetative and mood symptoms ( $r=.36$ ), and the 95% confidence interval for the difference between correlations was statistically significant ( $0.01 \leq r_1 - r_2 \leq 0.53$ ). When high-low groups were created using PT and SO vegetative symptoms ratings, SO-defined groups differed significantly on mood depression symptoms ( $t(29) = 4.90, p < .001$ ), whereas PT-defined groups did not ( $t(25) = 1.6, p > .10$ ).

**Conclusions:** Compared with PT ratings, SO ratings of vegetative depression symptoms appear to be more associated with other core depression symptoms (i.e., mood) in MS patients. Thus, vegetative depression symptoms may be interpreted differently in MS patients than significant others who observe them.

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**P. ARNETT & L. STROBER. Measuring Depression in MS: What do our Measures Actually Tell us?**

**Objective:** Common self-report depression measures render little consideration for the overlap of medical illness and depressive symptoms. Questionnaires made specifically for the medically-ill have dealt with this issue by removing neurovegetative symptoms. Such methods do not take into consideration that some individuals, ill or otherwise, endorse such symptoms in the presence of depression. Proper identification of which symptoms are related to depression and which are related to the illness is thus warranted. The present study proposes modifying the Beck Depression Inventory-I (MBDI-I) so that patients can rate the extent to which they attribute their endorsement of depression symptoms to their MS disease symptoms. This approach was then compared to common self-report measures.

**Participants and Methods:** 67 non-depressed MS patients, 17 depressed MS patients, and 22 healthy controls were administered the MBDI-I, Beck Depression Inventory-II (BDI-II), Beck Depression Inventory-Fast Screen (BDI-FS), and Chicago Multiscale Depression Inventory (CMDI).

**Results:** The BDI-FS, a measure designed for the medically-ill showed the greatest sensitivity (94%) followed by the BDI-II (88%). However, their specificity was 82% and 79%, respectively. The CMDI, a measure designed for use in MS obtained greater specificity (88%), but was least sensitive (77%). The proposed MBDI-I, which removed any contribution of MS symptoms, obtained the greatest specificity (93%) at a sacrifice of some sensitivity (71%).

**Conclusions:** Sensitivity is important in screening depression. However, greater specificity is necessary when a formal clinical diagnosis needs to be made. Based on these findings, the BDI-PC may be the best available tool for screening depression in MS, while the CMDI and MBDI-I may be best for making a formal diagnosis.

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## Paper Session 14: Cognitive Neuroscience

12:30–2:00 p.m.

### M.J. LARSON, D.A. KAUFMAN & W.M. PERLSTEIN. Neural Time Course of Conflict Adaptation Effects on the Stroop Task.

**Objective:** Cognitive control theory suggests that conflict effects are reduced following high- relative to low-conflict trials. Such reactive adjustments in control (i.e., “conflict adaptation effects”) indicate that a dynamic interplay between regulative and evaluative components of cognitive control is necessary for adaptive goal-directed behavior. The current study utilized scalp-recorded event-related potentials (ERPs) to examine the neural time course of conflict adaptation effects in healthy participants.

**Participants and Methods:** High-density ERPs were acquired while 36 healthy participants performed a single-trial Stroop task with 70% congruent and 30% incongruent randomly presented trials. Stroop stimuli preceded by incongruent (high-conflict) and congruent (low-conflict) trials were examined for behavioral (response time [RT] and error rate) and electrophysiological (N450 and conflict SP components of the ERP) concomitants of cognitive control.

**Results:** A conflict adaptation effect was present for RTs that could not be accounted for by associative priming. ERPs revealed a parietal conflict slow potential (conflict SP) that differentiated incongruent from congruent trials and also differed as a function of previous-trial context (i.e., showed conflict adaptation); the fronto-medial N450 was sensitive to current trial congruency but not to previous trial context. Thus, the conflict SP was sensitive to the effects of previous-trial context, while the N450 was so to a lesser extent and in a different pattern.

**Conclusions:** Findings clarify the neural time course of conflict adaptation and implicate the parietal conflict SP in controlled conflict resolution and adaptation processes, with the fronto-medial N450 reflecting more automatic conflict monitoring processes.

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### V. ELDERKIN-THOMPSON, R. GUPTA, G. HELLEMANN & A. KUMAR. Biophysical Correlates of Cognition among Depressed and Nondepressed Type 2 Diabetes Patients.

**Objective:** Magnetization transfer (MT) is an MRI-related approach used to study the biological integrity of myelin and axonal density in the white matter and macromolecular proteins in gray matter regions. We observed a decline in the saturated signal intensity of macromolecular proteins in the head of the caudate in diabetic patients that was exacerbated in patients with concurrent depression. The caudate is critical for cognitive function given its location within multiple corticostriatal neural pathways. This study examined the relationship between MR ratios of the caudate and cognitive performance.

**Participants and Methods:** Thirty-one diabetic patients (13 depressed and 18 nondepressed) and 28 healthy comparison subjects completed MR imaging, a panel of laboratory tests and a neuropsychological battery. MT ratios of the caudate and 3 comparison regions (putamen,

frontal white matter and anterior cingulate) were computed. Scores from the neuropsychological battery were aggregated into a global index of cognitive function that included working memory, attention, executive function, episodic recall, visuospatial conceptualization and language (Cronbach’s alpha = .90), and it was correlated with MT ratios.

**Results:** Caudate MT ratios correlated with cognitive performance among diabetic patients but not among healthy controls. Means of both caudate MT ratios and neurocognition declined step-wise from healthy controls to nondepressed diabetics to depressed diabetics, becoming more strongly associated with each step and suggesting a diabetic and depression effect on caudate function and cognitive performance. Comparison regions showed no evidence of a specific disease effect.

**Conclusions:** One mechanism precipitating cognitive loss during diabetes appears to be associated with cellular changes occurring in the macromolecular protein pool of the caudate.

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### D.L. DRANE, G.A. OJEMANN, J.G. OJEMANN, E. AYLWARD, D. SILBERGELD, J.W. MILLER & D. TRANEL. Category-Specific Recognition and Naming Deficits Following Resection of a Right Anterior Temporal Lobe Tumor in a Patient with Atypical Language Lateralization.

**Objective:** We explored the neural substrates of object recognition and naming for a wide range of unique (famous faces and landmarks) and non-unique (animals and man-made items) in a patient with right-hemispheric speech lateralization who underwent an anterior right temporal lobe (TL) resection of a ganglioglioma.

**Participants and Methods:** Our patient completed a standard neurocognitive assessment and specialized tests to assess semantic memory, object recognition and naming, and visuo-perceptual skills. He also underwent a Wada assessment to determine language lateralization and intraoperative cortical stimulation mapping to examine essential speech sites.

**Results:** Post-operatively, our patient exhibited severe recognition and naming deficits for unique objects but grossly normal recognition and naming performances for non-unique objects. Neurocognitive outcome otherwise involved mild but significant declines in select areas (e.g., memory) with no decline on standard naming measures.

**Conclusions:** While recognition deficits have been reported for famous faces following right temporal pole lesions, and for landmarks and geographic regions following right TL damage in general, this is the first reported case of both recognition and naming deficits for these objects resulting from a single lesion. Our results are consistent with research suggesting that the neuroanatomic substrates for the recognition and naming of unique objects lies in the anterior TL region (i.e., left temporal pole lesions are associated with naming deficits/right temporal pole lesions are associated with recognition deficits for unique objects). However, our findings suggest that the substrates of naming can be located in homotopic regions of the right hemisphere when language lateralization is atypical. As various object categories appear to have different neuroanatomical representations in the TL region, we discuss the need to use a broader array of object types for both neurocognitive testing and during cortical stimulation mapping of language.

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### S. CAVACO, S.W. ANDERSON, M. CORREIA, M. MAGALHÃES, A. TUNA, R. TAIPA, P. PINTO, C. PINTO, F. GOMES, J. DAMÁSIO, A. GONÇALVES, R. CRUZ, A. BASTOS LIMA, A. MARTINS DA SILVA, A. CASTRO-CALDAS & H. DAMÁSIO. Task specific involvement of striatum in perceptual-motor skill learning.

**Objective:** Acquisition of new perceptual-motor skills depends on multiple brain areas, including the striatum. However, the specific contribution of each structure to this type of learning is still poorly under-

stood. Focusing on the striatum, we proposed 1) to replicate the finding of preserved Mirror Tracing and impaired Rotary Pursuit in Huntington's disease; and 2) to further explore this putative learning dissociation between a dynamic visuomotor mapping skill (i.e., demands constant update of the motor program in response to a moving target, as in Rotary Pursuit) and an incongruent visuomotor mapping skill (i.e., involves an indirect relationship between motor response and visual feedback, as in MT).

**Participants and Methods:** The performances of participants with striatal dysfunction (i.e., 12 patients with Huntington's disease, 20 patients with Parkinson's disease, and 24 focal vascular damage) and 15 patients with focal damage in other brain areas were compared to those of 68 healthy individuals on four perceptual-motor skill learning tasks (i.e., Mirror Tracing, Rotary Pursuit, and two new tasks that share specific cognitive demands with Mirror Tracing and Rotary Pursuit, respectively - Control Stick, and Geometric Figures).

**Results:** Regardless of the aetiology, participants with damage to the striatum, but not those with damage to other brain regions, showed impaired learning of dynamic visuomotor mapping skills (i.e., Rotary Pursuit and Geometric Figures), but demonstrated normal improvement over practice on incongruent visuomotor mapping skills (i.e., Mirror Tracing and Control Stick).

**Conclusions:** These results suggest a task specific involvement of the striatum in the early stages of perceptual-motor skill learning.

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## Symposium 12: Becoming a Clinical Neuropsychologist, From Graduate School to Board Certification

Chair: Linas Bieliauskas

12:30–2:00 p.m.

**J.F. STRANG, P.K. SHEAR, M. LACY, M.D. HORNER, J. DONDERS & L.A. BIELIAUSKAS. Becoming a Clinical Neuropsychologist, From Graduate School to Board Certification.**

**Symposium Description:** This symposium will address issues relevant to students and early career psychologists pursuing a career as a clinical neuropsychologist. The panel will explore issues from predoctoral education and training in clinical neuropsychology in the context of psychology training programs to board certification as a clinical neuropsychologist. Specific areas to be addressed include: 1) "broad and general" training vs. specialization at the predoctoral level, 2) completing an internship that prepares you for a postdoctoral fellowship in neuropsychology, 3) current status and implications of the Houston Conference on Specialty Education and Training in Clinical Neuropsychology, and 4) completing the required two year postdoctoral Residency/Fellowship, including the national match program operated by the Association of Postdoctoral Programs in Clinical Neuropsychology (APPCN).

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**P.K. SHEAR. Predoctoral Education and Training in Clinical Neuropsychology.**

**Objective:** This presentation will focus on how to prepare for a career in clinical neuropsychology at the predoctoral level. Neuropsychology related coursework, tracks, "areas of concentration", and practica experiences discussed. Issues related to "broad and general" training vs. specialization will be considered, as will Houston Conference guidelines. Correspondence: John F. Strang, Children's National Medical Center, 111 Michigan Ave NW, Washington, DC 20010. E-mail: johnstrang@aol.com

**M. HORNER & M. LACY. Preparing for a Career in Clinical Neuropsychology: The Pre-doctoral Internship.**

**Objective:** A one-year internship is the final component of pre-doctoral study in clinical psychology. This presentation will address issues of interest to students who will be applying to internship programs with specialty training in neuropsychology. Topics will include the range of training options available at the internship level, choosing among internship programs, strategies for the application and interview process, and characteristics of successful candidates. Resources including the Association for Internship Training in Clinical Neuropsychology (AITCN) will be introduced.

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**J. DONDERS. Overview of Postdoctoral Training in Clinical Neuropsychology.**

**Objective:** A two-year postdoctoral residency (or fellowship) is now required for board certification in clinical neuropsychology. This presentation provides a brief orientation to postdoctoral training that is aimed at graduate students and interns who are preparing for a career in clinical neuropsychology. This presentation describes the features of postdoctoral training programs, the background qualifications of successful applicants, and application procedures. Information will be presented about the national match operated by the Association of Postdoctoral Programs in Clinical Neuropsychology (www.appcn.org).

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**L. BIELIAUSKAS. Board Certification in Clinical Neuropsychology.**

**Objective:** This presentation will describe the process of applying for board certification in clinical neuropsychology through the American Board of Clinical Neuropsychology. Board certification is the next step in the sequence of training in the specialty of clinical neuropsychology after the postdoctoral residency. The board certification examination assesses competence in the practice of clinical neuropsychology. It evaluates not only fund of knowledge but also the ability to apply neuropsychological principles in the clinical setting and promote the welfare of the patient. The goal of this presentation is to review the policies and procedures of the American Board of Clinical Neuropsychology, familiarize potential applicants with steps in the process, provide advice around preparation for the examination, and describe supports and resources available.

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