Training Aphasia Patients to Provide Their Own Internal Cues: Two Case Studies

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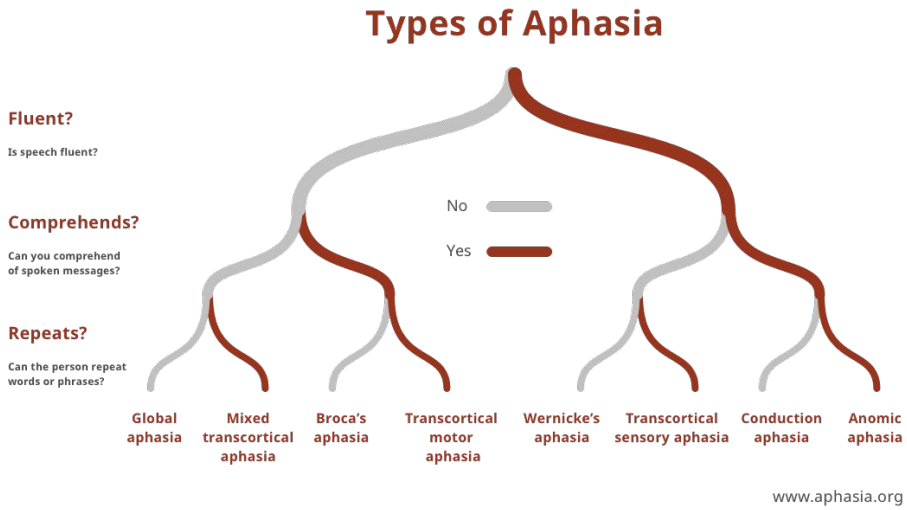
Speaker Introduction/Disclosures

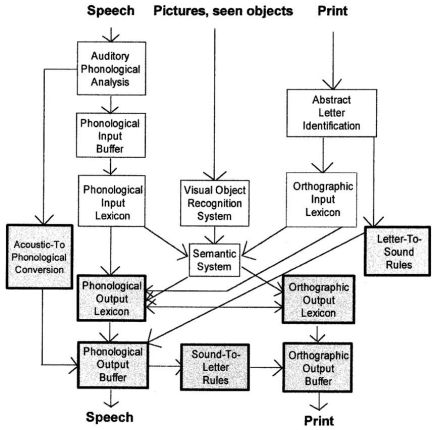
No relevant financial or nonfinancial relationships to disclose.

What is aphasia?

- An impairment in expression and/or comprehension of spoken and/or written language
- Currently affects over 2 million Americans
- Most common etiology is stroke
- Left hemispheric dominance (usually)
  - Frontal lobe: praxis, high-level syntax comprehension
  - Parietal lobe: integration of information, association, repetition
  - Temporal lobe: comprehension, phonological processing, linguistic memory



Ellis & Young (1988) model of language processing



Common naming errors in aphasia

- **Anomia: "They're getting food out of their picnic...I can't think of the word."**
- **Paraphasias**
  - **Semantic: "That's a picnic bag."**
  - **Phonemic: "They have a picnic gasket."**
  - **Neologism: "Here's a flickstag."**
- **Perseveration: "That's a blanket, and they get food out of their blanket."**
- **Circumlocution: "They're doing...where you put food on a blanket on the ground."**
- **Conduit d'approache: "That's their picnic pack...pask...basp…"**

Types of cues to aid word retrieval

- Phonemic: "Ba..." or "bas..."
- Semantic: "It's woven from wicker, and has handles."
- Gestural: (mime carrying/opening basket)
- Cloze: "A tisket a tasket, a green and yellow…"

Problems with external cueing

- Reduced independence of communication
- Communication partners often naive to target word
- **These issues still apply to AAC/total communication approach**

“Internal” cueing?

Two patients treated at hospital outpatient clinic

- Different aphasia classifications
- Both aware of errors
- Both demonstrated favorable response to external cueing

Patient A: Case History

- 66-year-old female
- PMH: HTN, HLD, anxiety/depression, arthritis, essential tremor, cataracts, and glaucoma
- Retired hairstylist; cosmetology school education
- Presented to ED at local hospital; GLF and AMS with R weakness
- Admitted, stroke workup > d/c to subacute rehabilitation >d/c home two weeks later

Patient A: Neuroimaging Findings

Brain MRI: early subacute infarct involving left posterior frontal and parietal lobes in the left middle cerebral artery (MCA) territory, with small hemorrhagic component

Patient A: Findings at Initial Outpatient Assessment

- **Boston Diagnostic Aphasia Examination (Short Form)**
  - **Auditory Comprehension - relatively strong**
  - **Conversational and Expository Speech**
    - Fluent with preserved sentence structure and prosody with predominantly phonemic paraphasias
  - **Oral Expression***
    - Automatized Sequences: 33% accuracy
    - Repetition: 70% accuracy for single words, 20% accuracy for sentences
    - Responsive Naming: 71% accuracy
- **Boston Naming Test (Short Form)**
  - **Confrontation Naming***
    - 7% accuracy independently
    - 40% accuracy given phonemic cues
    - 87% accuracy given 4 written choices

Patient A: Continued Results of Initial Outpatient Evaluation

- **Boston Diagnostic Aphasia Examination (Short Form)**
  - **Reading**
    - Basic Symbol Recognition: 75% accuracy
    - Picture-Word Match: 75% accuracy
  - **Writing - not administered due to time constraints at initial evaluation**

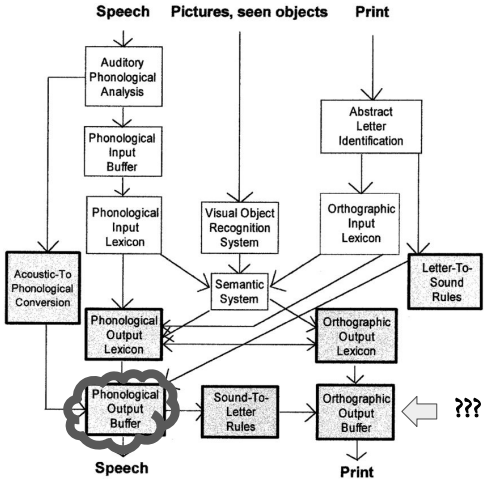
Recommendation: Speech therapy twice weekly for 4-8 weeks

Patient A: Deficits and Strengths

DEFICITS	STRENGTHS
❖ Phonemic paraphasias (typically nonwords) in naming tasks, oral reading, spontaneous speech, and repetition	❖ Comprehension (auditory and reading) ❖ Fluency/praxis and grammaticality ❖ Awareness of errors; conduit d'approache

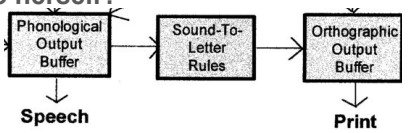
Profile is most consistent with conduction aphasia!

Patient A: Where is the naming impairment?



Patient A: "Internal" phonemic cueing?

- Phonemic paraphasias primarily substitutions of initial phonemes (e.g., "froke" for "stroke"); at minimum, syllable nuclei (e.g., vowels) strongly resembled the target word (e.g., "yunt" for "hunch").
- Able to produce the target word given a phonemic cue (i.e., initial phoneme) from another person
- Existing treatment: phonological components analysis (PCA; Leonard et al, 2008)
- **Could explicit training in phonological skills enable her to provide phonemic cues to herself?**



University of Arizona Aphasia Project (Beeson)

- **Evidence that most perisylvian aphasia patients (such as Broca's, Wernicke's, conduction, and global) have poor phonological skills**
  - **Alexia - reading impairment**
  - **Agraphia - writing impairment**
- **A treatment sequence was designed to rehabilitate written language skills, <u>which could also be used as "prerequisite" for training self-cueing for spoken lexical retrieval</u>**
- **Arizona Battery of Reading and Spelling**
  - **Phonological agraphia -** >80% accuracy on spelling portion, predominantly phonological impairments, more difficulty with low-frequency words and nonwords
  - **Global agraphia -** <80% accuracy on spelling portion, lexical/semantic and orthographic as well as phonological impairments, difficulty with all types of stimuli

Where does Patient A fit?

- **Arizona Battery of Reading and Spelling**
  - **Reading: 33% overall accuracy**
    - 3/10 high frequency/phonologically regular
    - 6/10 low frequency/phonologically regular
    - 1/10 high frequency/phonologically irregular
    - 3/10 low frequency/phonologically irregular
  - **Spelling (writing to dictation): 50% overall accuracy**
    - 4/7 high frequency/phonologically regular
    - 5/9 low frequency/phonologically regular
    - 3/7 high frequency/phonologically irregular
    - 3/7 low frequency/phonologically irregular

<80% accuracy on spelling = start with lexical/semantic treatment

Lexical/Semantic Treatment (Beeson)

Copy and Recall Treatment (CART)

- Goal: to strengthen/retrain spellings of specific words (can be standard set and/or personally relevant words for patient) - **semantic system** and **phonological output lexicon**
- Prerequisite for phonological treatment
- Can also establish "key words" to use in next step (i.e., phonological treatment)
- Homework every session
- Specific protocol and standard stimuli available on https://aphasia.arizona.edu/

Phonological Treatment (Beeson)

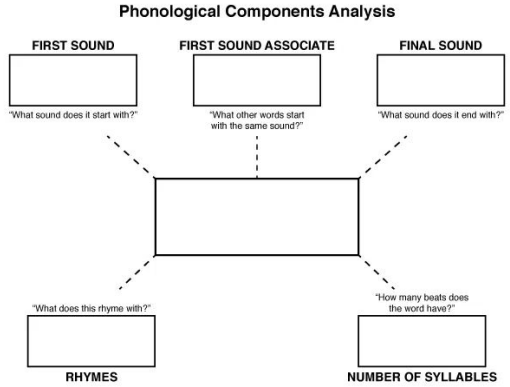
- When patient able to read and write/spell the "key" words (trained via CART if applicable), move on to explicit phonological training (typically consonants first, then vowels):
  - Sound-letter correspondence
  - Letter-sound correspondence
  - More advanced tasks, including but not limited to:
    - Blending
    - Segmenting
    - Matching
    - Phonemic generative naming
    - Rhyme judgment
- Traditionally followed by interactive spelling treatment (independent error correction)
- Full protocol and more information available on https://aphasia.arizona.edu/

Patient A: Treatment Sequence

- Lexical-semantic treatment to prepare for phonological treatment
  - 7 sessions before beginning to “mix” phonological treatment in; 10 sessions total
  - Personally relevant stimuli: “orange,” “help,” “pain,” “stroke,” “mail,” “water,” “steak,” “phone”
  - From standard Beeson stimuli: “dog,” “hat,” “net,” “top,” “van,” “web,” “pie,” “bone,” “cake,” “goat,” “safe,” “fire,” “rug,” “ship,” “moon,” “zoo,” “chin,” “judge”
- Phonological treatment
  - 4 sessions total (3 “mixed” with lexical-semantic)
  - Reached 100% accuracy for letter-sound and 80% accuracy for sound-letter for (/p/, /b/, /k/, /s/, /g/, /f/)
  - Reached 90% accuracy for letter-sound and 90% accuracy for sound-letter for (/r/, “sh,” /m/, /z/, “ch,” “j”)

Patient A: End Results

- Self-discharged after 6 weeks of therapy (satisfied with progress)
- Phonological components analysis (PCA) introduced as compensatory strategy



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Patient A: Reassessment

	Initial Evaluation	Final Session
BNT short form - independent accuracy	7%	40%
BNT short form - with phonemic cues	40%	53%
BNT short form - with 4 written choices	87%	100%
Picture description	Phonemic paraphasias, anomia, circumlocutions, empty speech	Able to self-correct all phonemic paraphasias except one

Patient C: Case History

- 69-year-old female
- PMH: HTN, HLD, anxiety, osteoporosis, thyroid disease, and lumbar osteoarthritis
- Worked as a substitute teacher
- Arrived at local hospital ED via EMS with R weakness, R facial droop, and inability to speak
- Head CTA: large clot in M3 segment of MCA
- tPA administered > transferred to comprehensive stroke center > d/c to acute inpatient rehabilitation > d/c home

Patient C: Neuroimaging Findings

Brain MRI: small to moderate volume of water restriction on diffusion-weighted imaging involving the left posterior frontal and perirolandic cortex and subcortical white matter, compatible with a recent left MCA distribution infarct

Patient Findings from Initial Outpatient Evaluation

- **Boston Diagnostic Aphasia Examination (Short Form)**
  - **Auditory Comprehension - relatively strong**
  - **Conversational and Expository Speech**
    - Non-fluent with agrammatism, apraxia of speech
  - **Oral Expression***
    - Automatized Sequences: 25% accuracy
    - Repetition: 20% for single words, 50% for sentences
    - Responsive Naming: 20% accuracy
  - **Reading**
    - Basic Symbol Recognition: 100% accuracy
    - Picture-Word Match: 100% accuracy
  - **Writing**
    - Mechanics of Writing: 100% accuracy
    - Basic Encoding Skills (dictated words): 100% accuracy
- **Boston Naming Test (Short Form)**
  - **Confrontation Naming***
    - 13% accuracy independently

Patient C: First Month of Outpatient Therapy

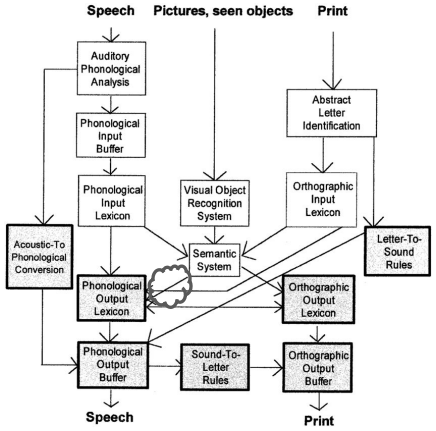
- **Recommendation: Speech therapy three times weekly for 8-12 weeks**
- Fluency/praxis, grammaticality, and information content of spontaneous speech improved
- Lexical perseverations and semantic paraphasias began to predominate
- Although written naming initially impaired at evaluation, dramatically improved in first month of therapy
  - Used notebook and pencil as a low-tech AAC method (mostly for single words) using left non-dominant hand
  - Able to point to letters and numbers on low-tech AAC alphabet board to spell words (even when unable to verbalize them)

Patient C: Deficits and Strengths

DEFICITS	STRENGTHS
❖ Nonfluent, often agrammatic speech ❖ Apraxia ❖ Perseverations (and less frequently, non-perseverative semantic paraphasias) in naming tasks, spontaneous speech, repetition, and oral reading	❖ Auditory comprehension and reading comprehension ❖ Written expressive language/spelling and ability to use low-tech AAC (letter and number board) ❖ Awareness of 90-100% of paraphasias/perseverations

Profile is most consistent with ???? aphasia?

Patient C: Where is the naming impairment?



Patient C: "Internal" cueing?

- Naming errors only in verbal lexical selection/retrieval
- Would respond to external cloze cues, occasionally with a phonemic cue
- Due to possible promising results for Patient A 2 years earlier, phonological treatment initiated

Patient C: Phonological Treatment Sequence

- Lexical-semantic treatment deemed unnecessary due to high baseline spelling accuracy.
- Initiated Beeson's phonological treatment protocol
  - 6 sessions to train all phonemes in the protocol (consonants and vowels)
  - Most difficulty with /z/, "sh," and "ch" consonants, as well as vowel phonemes
  - Reached criterion (80-100%) for sound-letter awareness of all phonemes
  - Reached criterion for letter-sound when vowel approximations were accepted (distorted due to apraxia)
- Probed ability to "self"-cue after the 6 sessions
  - Patient C still required external cueing (e.g., "Remember your key word for this sound")
  - Also often required a (self) written model
  - Phonological components analysis (PCA) more helpful, but still not efficient and required external cueing
- Her tendency towards perseveration had not significantly changed (even with written models)...why?

Aphasic Perseverations: Possible Explanations

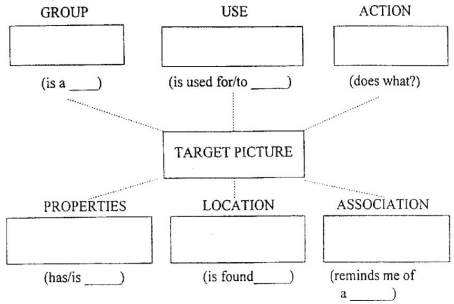
- "Pseudo-apraxia" (Pick, 1892)
- Perseveration fills in the "gap" due to the underlying language impairment (Heilbronner; Lissauer)
- "Over-activation" of previous response (von Solder)
- "Under-activation" of intended response (Pick)
- Too little input for intended response *and* too much activity/activation from a previous trial - at multiple levels of language processing (Cohen and Dehaene)

Alternative “internal” cueing strategy for Patient C?

- Despite inconsistent success with self-cueing, reported that phonological treatment had been helpful
- Independently began attempting to self-cue aloud (automatic speech and cloze cues)
  - “14, 15, 16” for target word of “sixteen”
  - “Pots and pans” for target word of “pan”
- **<u>Would she be better served by a semantic approach</u>** to supplement phonological approach?

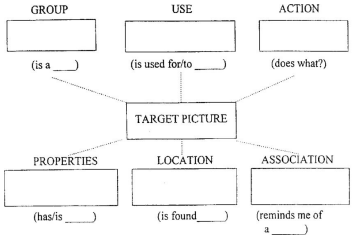
Semantic Feature Analysis (SFA) for Nouns

- Theory: by activating semantic information “surrounding” a target word, higher likelihood the target will be activated
- First described by Ylvisaker & Szekeres in 1985
- More detailed research by Mary Boyle
  - 1995 single-subject case study with Carl Coelho: use of graphic organizer with nonfluent aphasia; positive effects generalized to confrontation naming of untrained stimuli, but no change in connected speech



Semantic Treatment for Patient C: Nouns

- Relatively strong baseline semantic skills, minimal-to-no naming impairments in written language
- 4 formal sessions (some concurrent with phonological treatment and/or additional semantic approach to be described later) targeting use of graphic organizer with emphasis on speaking each attribute aloud as a “self” cloze cue (motor priming for “pseudo-apraxia”?)
  - E.g., “sit at the *table*,” “kitchen *table*,” “*table* and chairs”
  - **<u>Able to retrieve and produce target words in 90-100% of opportunities (i.e., when causing difficulty) during sessions</u>**

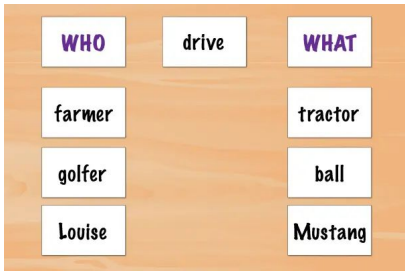


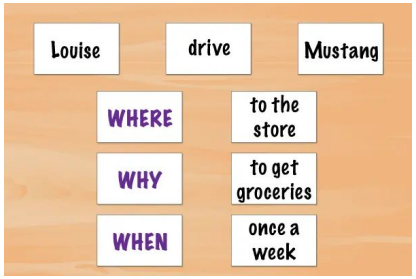
Patient C: Beyond nouns?

- Dysfluency, occasional agrammatism, and reduced MLU/information content continued to negatively impact effectiveness of spoken language
- Confrontation naming of **<u>verbs</u>** probed during a session where SFA was being targeted
  - 40% accuracy independently
  - Increased to 100% accuracy when encouraged to **<u>create a sentence given information from picture scene (i.e., agent and patient)</u>**
- Best way to train Patient C to do this independently?

Verb Network Strengthening Treatment (VNeST)

- First proposed by Lisa Edmonds (2009)
- Protocol:
  - Given one verb, generate 3 agent-patient pairs
  - Answer "wh" questions about one pair
  - Semantic judgment of SLP-created sentences using the trained verb
- Generalization to confrontation naming of untrained nouns *and* verbs

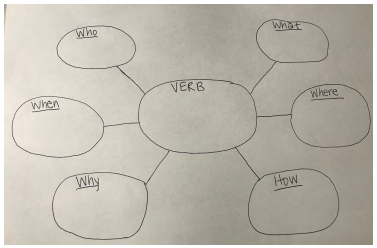




https://tactustherapy.com/vnest-verb-network-strengthening-app/

Semantic Treatment for Patient C: Verbs/Sentence Structure

- Inspired by VNeST; modified approach
- 6 formal sessions (some concurrent with SFA treatment) targeting use of verb-centered graphic organizer to create detailed sentences
- Unlike in original VNeST protocol, specific stimuli provided
  - Line drawings of scenes
  - Later written prompts (e.g., "I saw…")
- Reached 80-85% accuracy independently/verbally, increasing to 100% given self written cues
- Eventually able to "mentally" picture graphic organizer for independent use



Patient C: Reassessment

	Initial evaluation	After 8 total weeks of therapy (4 weeks of "self-cueing" training)
BNT short form - independent accuracy	10%	67%
Picture description ("cookie theft")	"Dishes, food, water. Family fight. Girl, boy."	"In this picture, uh, the, uh, lady is uh…(unintelligible) let me see…uh…cleaning the dishes. Uh, the water is on the floor. Uh, um, the boy…the boy and the girl…ta-…let's see…taking the ha…I'm sorry. The uh, um, boy…the girl, and the girl are taking the cookie jar. Um, the little boy is going to, uh, fall in the chair. It's not a chair…stool."

Patient C: End Results

- Continued therapy on a tapered schedule (twice a week, once a week, twice a month, once a month) for 5 more months (total of 7 months; 48 visits)
  - Later sessions focused upon independent use of self-cueing strategies in conversation-level tasks
  - Patient C benefited from a combination of all approaches (phonological, semantic with noun focus, and semantic with verb focus)
- At time of discharge, independently self-correcting 90-95% of communication breakdowns, with continued but less frequent use of notebook for low-tech AAC
- Still with limited socialization outside her home, and not interested in returning to work, due to circumstances surrounding COVID-19 pandemic

“Internal” cueing: Possible conclusions

- Implications of cases of Patient A and Patient C:
  - Awareness of errors and attempts at self-correction prior to treatment = positive prognostic indicator for “internal” cueing
  - Promising results for “internal” cueing for mild-moderate phonemic paraphasias, semantic paraphasias, lexical perseverations, and agrammatism
  - Possible bidirectional connections in Ellis & Young model, including between:
    - Sound-letter/letter-sound awareness and phonological output buffer
    - Phonological output buffer and phonological output lexicon
    - Phonological output lexicon and semantic system
  - Possible support for Pick’s “pseudo-apraxia” theory of verbal perseverations
  - **“Internal” cueing training should be considered for aphasia patients with post-semantic impairments**
- Areas for further study:
  - “Internal” cueing for semantic impairments, and/or comprehension impairments?
  - Possible similar training for primarily orthographic impairments?

Questions/Comments?

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