ESCAN 2022

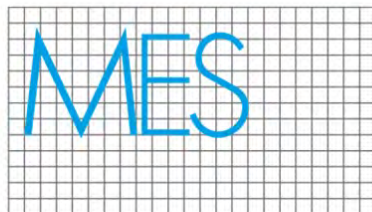**6th bi-annual conference of the
European Society for Cognitive and Affective Neuroscience**

program
Vienna 19-22 July

Exhibitors & Sponsors

Local Organizing Committee

Giorgia Silani
Claus Lamm
Emilio Chiappini
Helena Hartmann
Claudia Massaccesi
Isabella Wagner

University of Vienna,
Faculty of Psychology
Liebiggasse 5,
1010 Vienna
Austria

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Manos Tsakiris
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https://www.escan2022.eu/

WELCOME ADDRESS ESCAN President

Manos Tsakiris

President of ESCAN

Dear colleagues and friends,

On behalf of our Society's Board, I would like to warmly welcome you to ESCAN 2022, the 6th conference of the European Society for Cognitive and Affective Neuroscience in Vienna, Austria. After the challenging times marked by the world-wide COVID-19 pandemic, which prevented us from meeting in person and forced us to re-think the way we do science and communicate with others, we now look very much forward to meeting you in person in Vienna, one of the most beautiful European cities that seamlessly connect Central and Western Europe.

At our conference In Vienna, we will welcome three outstanding keynote speakers (**Rebecca Lawson, Morten Kringelbach, Stefanie Höhl**), the two recipients of the ESCAN Young Investigator Award (**Camilla Nord, Emiel Cracco**), and speakers participants from several countries across the world. We hope that once again we will succeed in promoting the mission of the Society to advance cognitive, affective, and social neuroscience and celebrate and promote scientific excellence across all career stages. A special emphasis has been also devoted to Open Science, which led us to confer a 'Commendation Award for Open Science' to **Lei Zhang** for his commitment to the advancement of Open Science practices in our fields of research.

We are very excited about the range of symposia (27), oral presentation sessions (23), and poster sessions (2) that we will have in this year's programme, all of which intend to motivate fruitful discussions and hopefully foster some new collaborations for our members and participants. Our sincere thanks go to the local organizing committee, Giorgia Silani, Claus Lamm, Helena Hartmann, Isabella Wagner, Claudia Massaccesi and Emilio Chiappini who worked tirelessly for this conference. I am sure it will be a successful, exciting and stimulating meeting that will bring together our community of past and new members.

I look forward to welcoming you in person!

On behalf of the Society's board,

Manos Tsakiris, President of ESCAN

WELCOME ADDRESS Chairs Organizing Committee

Giorgia Silani & Claus Lamm

Chairs of the organizing committee

We are very happy to welcome you to ESCAN 2022 in Vienna, and to provide a time and space where the ESCAN community can finally meet and interact in person again. We are particularly pleased to welcome about 350 registered participants from more than 30 nations, including many European countries, but also numerous attendees from overseas. An exciting scientific program is awaiting us over the three days of the conference: 3 keynote lectures, 27 submitted symposia and 115 oral presentations and, last but not least, more than 100 posters.

In planning the conference, we have tried to address some of the things that the pandemic has taught us over the last two years. First, we need to see, talk and connect to each other more than ever. That's why we have kept the cost of the conference as low as possible, in order to allow many of us but especially the early career researchers to travel to Vienna and meet in person again - after a long time of being constrained to virtual interactions. At the same time, we know that traveling has a tremendous impact on the environment. Therefore, we aimed to reduce the environmental impact of the conference as much as possible (see https://www.escan2022.eu/general-information/sustainability/ for more info).

There **will not be any printed program**. Everything that is essential for a worthwhile conference experience will be provided online and easily accessible, including from your phone. We also decided **against the usual goodies handed out by sponsors or organizers** – mostly, they would end up in the garbage bin anyways. As we cannot make an inpat alone, we also count on the collaboration of each one of you: therefore, **you will be given a reusable cup** from the local startup **mycoffeecup** for the beverages served at the complimentary coffee breaks. Please bring this cup with you to the conference, and re-use it all five coffee breaks. You can keep the cup after the conference, and continue using it back home – or return it. With this small action we will be able to avoid the waste of up to 3000 single use cups! Finally, **we will compensate the carbon emissions caused by the local activities** of the conference to a large extent, and would like to ask you to consider doing the same for your travel-related emissions.

We hope you will enjoy the conference, and that you look forward as much as we do to meet in person at the opening reception in the Vienna City Hall, and of course at the conference itself.

Giorgia Silani and Claus Lamm,

on behalf of the ESCAN 2022 organizing team from the University of Vienna (Emilio Chiappini, Helena Hartmann, Claudia Massaccesi, Isabella Wagner, and many other volunteers that supported us).

CONFERENCE INFORMATION

Conference Venue

The 6th international conference of the European Society for Cognitive and Affective Neuroscience (ESCAN) takes place between 19-22 of July, 2022 at:

Teaching Center,
Campus WU,
Vienna University of Economics and Business
Welthandelsplatz 1
1020 Vienna
Austria

The WU campus is located close to a very nice area of Vienna, the so-called "Prater", with the Prater main alley surrounded by lush meadows and forests nearby as well as an all-year amusement park that hosts one of the major Vienna hallmarks, the giant ferris wheel ("Riesenrad").

You will easily find the conference venue by following the directions listed here. Please also see the overview map below on how to find your way from the subway to the conference venue. Ideally you exit at U2 subway stop KRIEAU or MESSE PRATER, which is located 5 min by foot from the venue. B = Teaching Center.
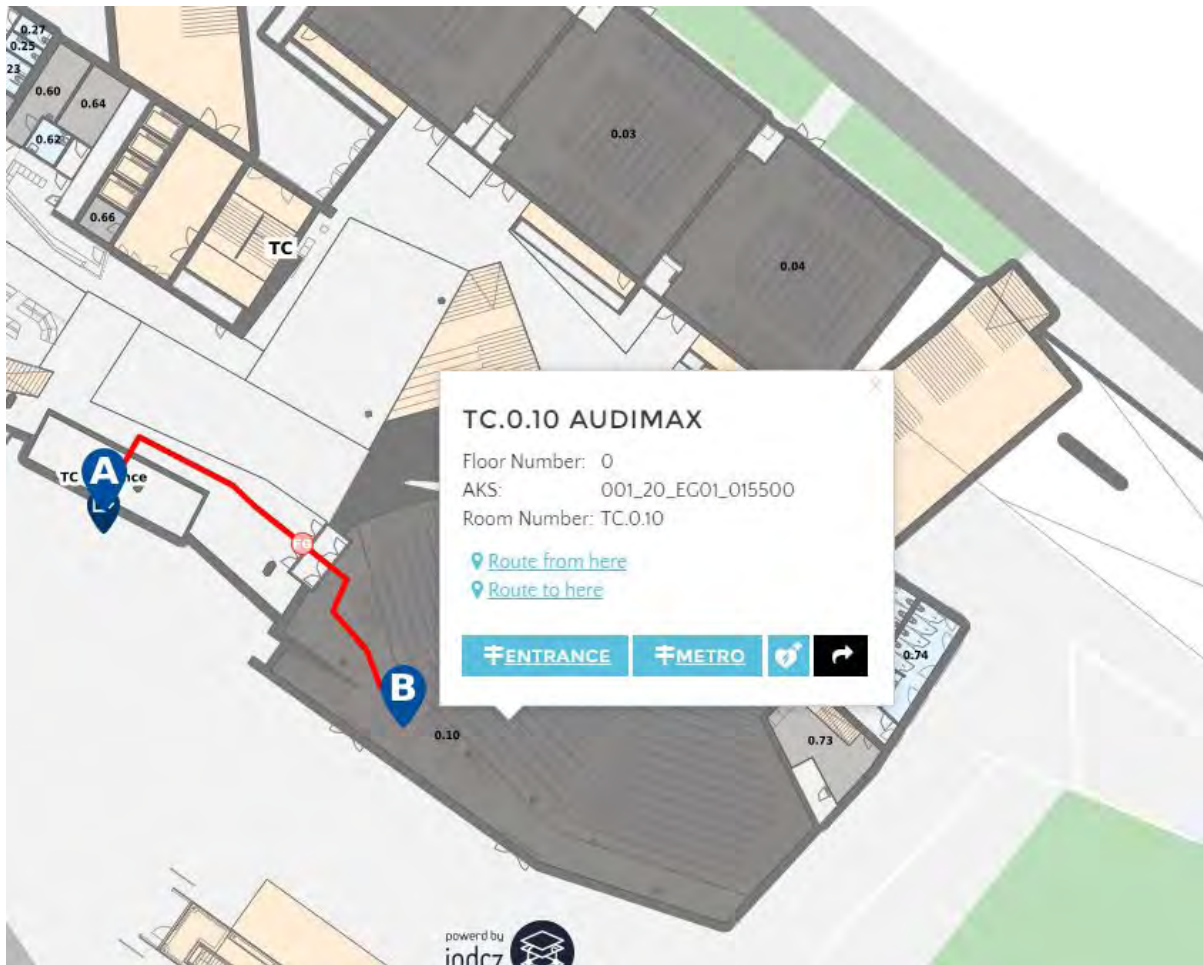
The lectures will take place in various lecture halls, located on the ground floor ("Audimax") as well as on the 5th floor (TC.5.01 to TC.5.15). Poster sessions will be held on the second floor, the so-called "Lernzone". But do not worry – once you are in the building you will easily find your way around, and if not, our staff members will help you find your way.

Please note: Admission controls will require you to wear your name badge!

UNDERGROUND STATION
MESSE PRATER
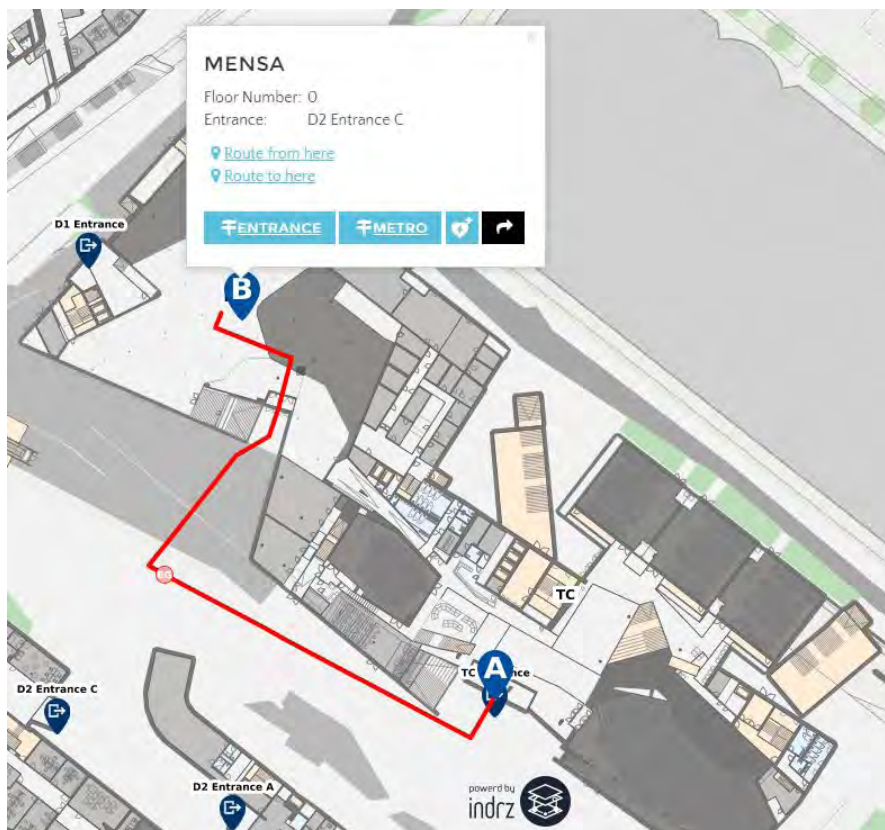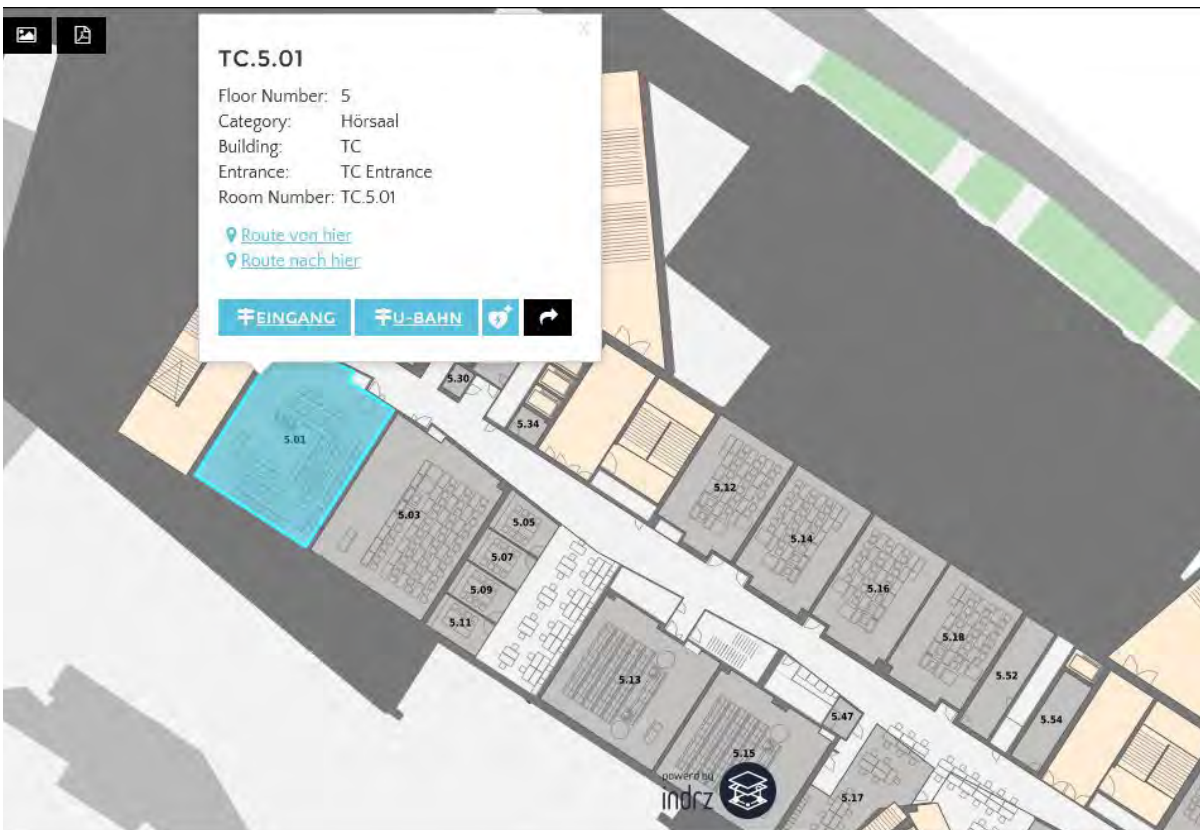
UNDERGROUND STATION
KRIEAU

escan

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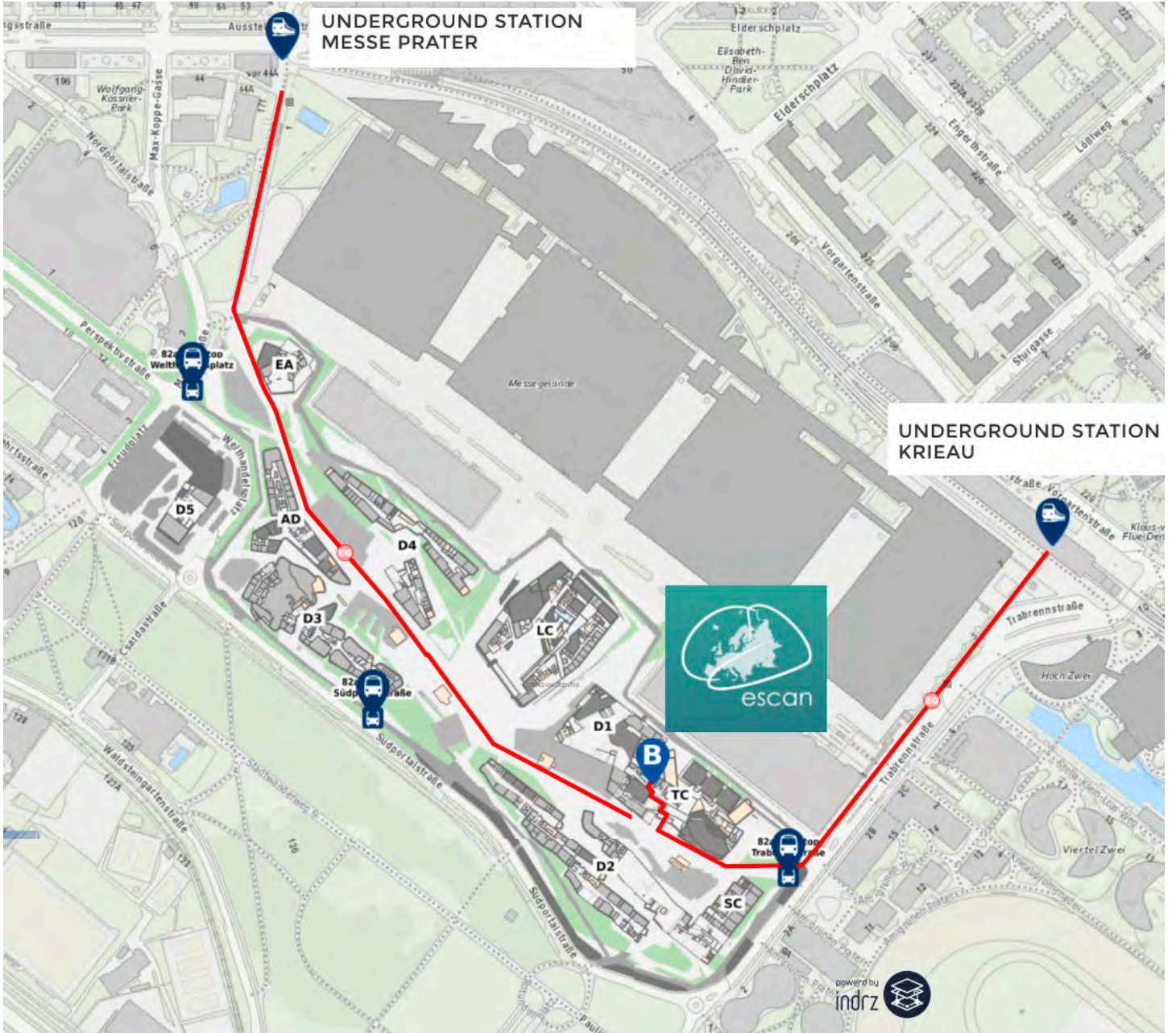
Audimax: Keynotes, Young Investigator, Award, General assemly, Closing cerimony

Mensa: Coffee breakes

TC.5.01-15: Symposia and oral presentations
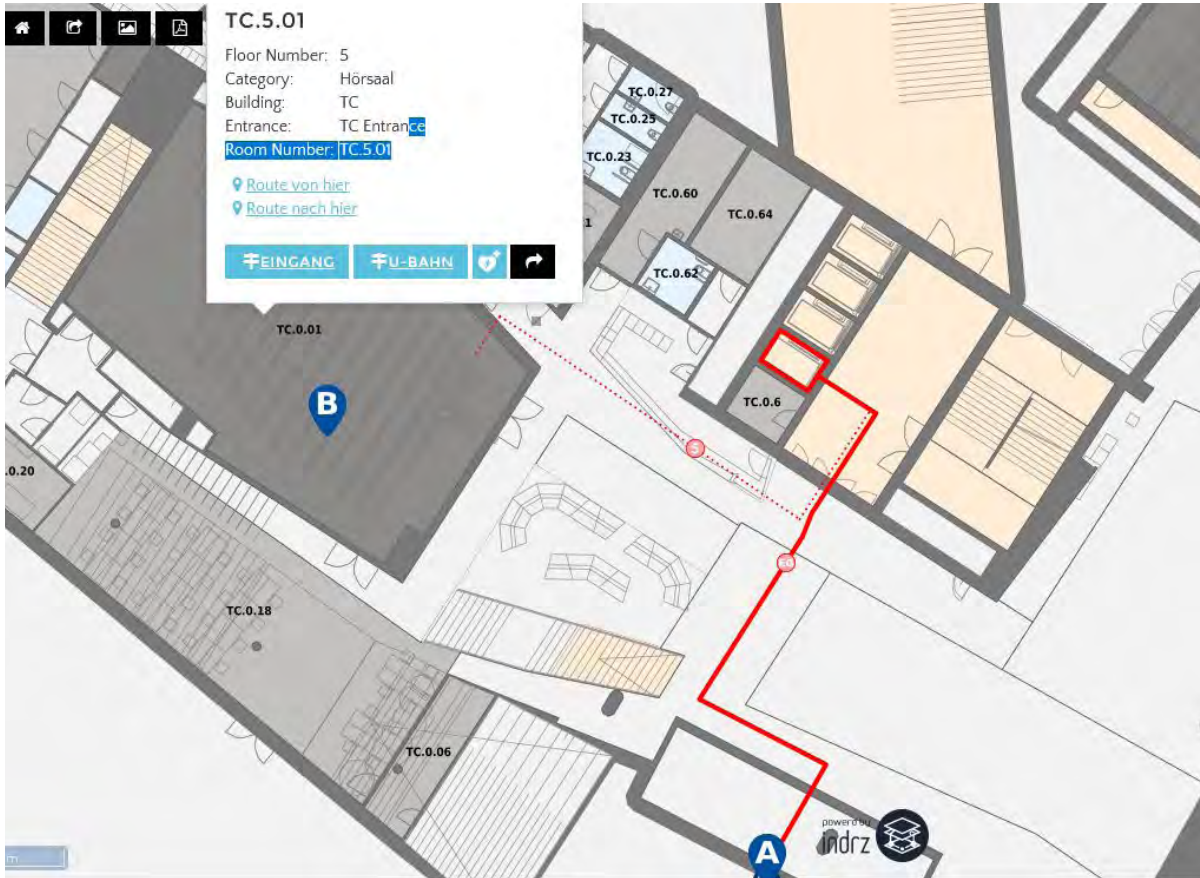
TC.2.07-15: Poster sessions

Travel to Vienna

We would like to encourage sustainable travel. If you would like to offset your travel footprint, you can do this for example here. Vienna can also be conveniently reached by various (night) trains: Check the picture below and here for the widespread train network to Vienna.

Public transportation in Vienna

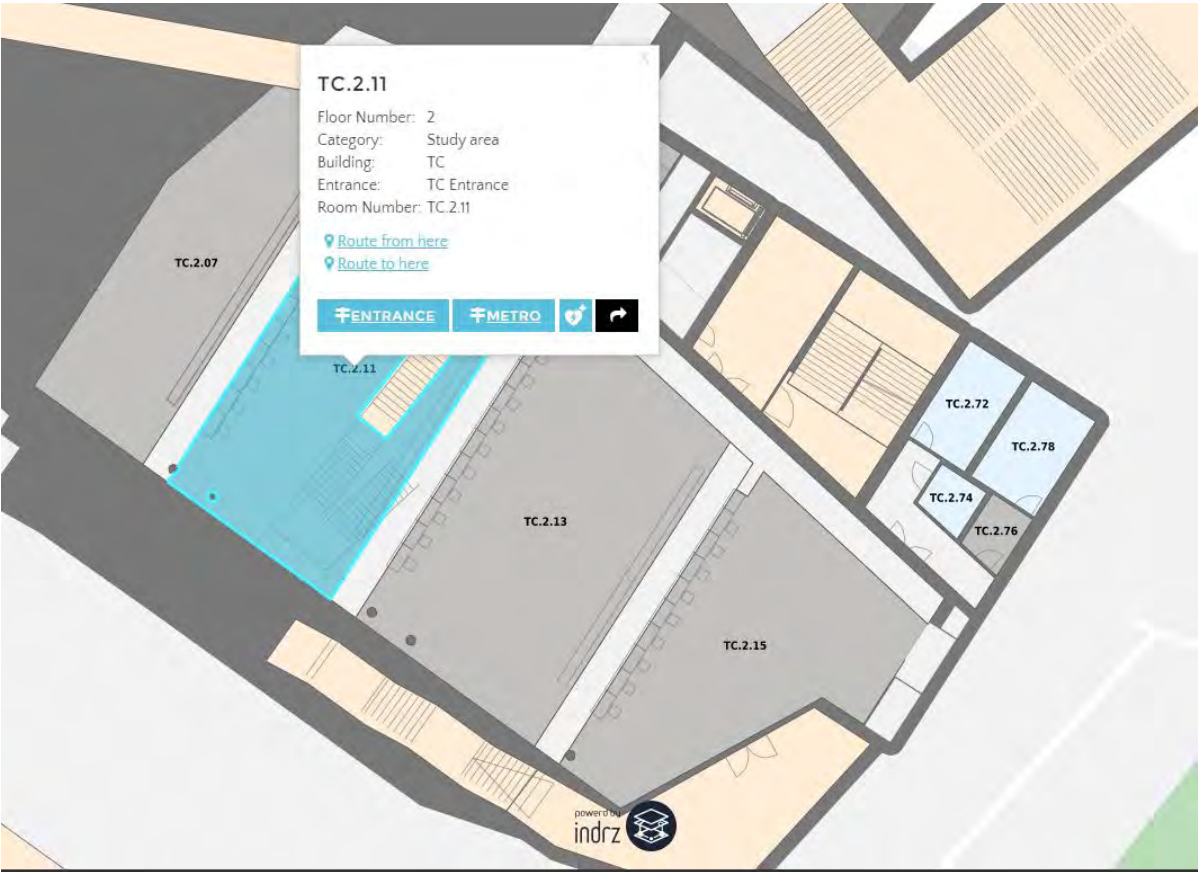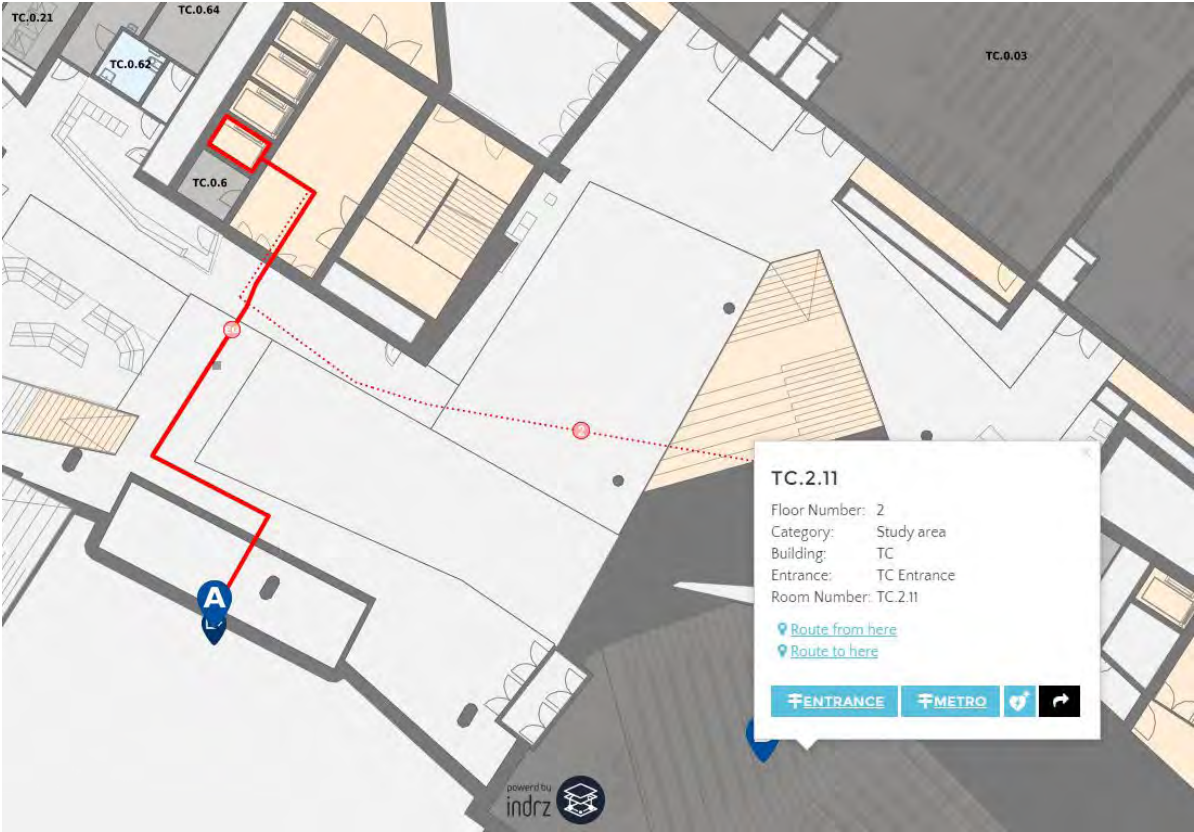Vienna has a very good public transportation system covering all parts of the larger Vienna area with subways, trams, and buses. Tickets are inexpensive, and you can also travel safely at night. To plan your travel within Vienna, we recommend you to use this website, or this app (here's another one). The venue can be most conveniently reached by subway line U2, stop "Messe-Prater" or "Krieau", which brings you close to the Vienna city center in only three stops and about 5 min riding time.
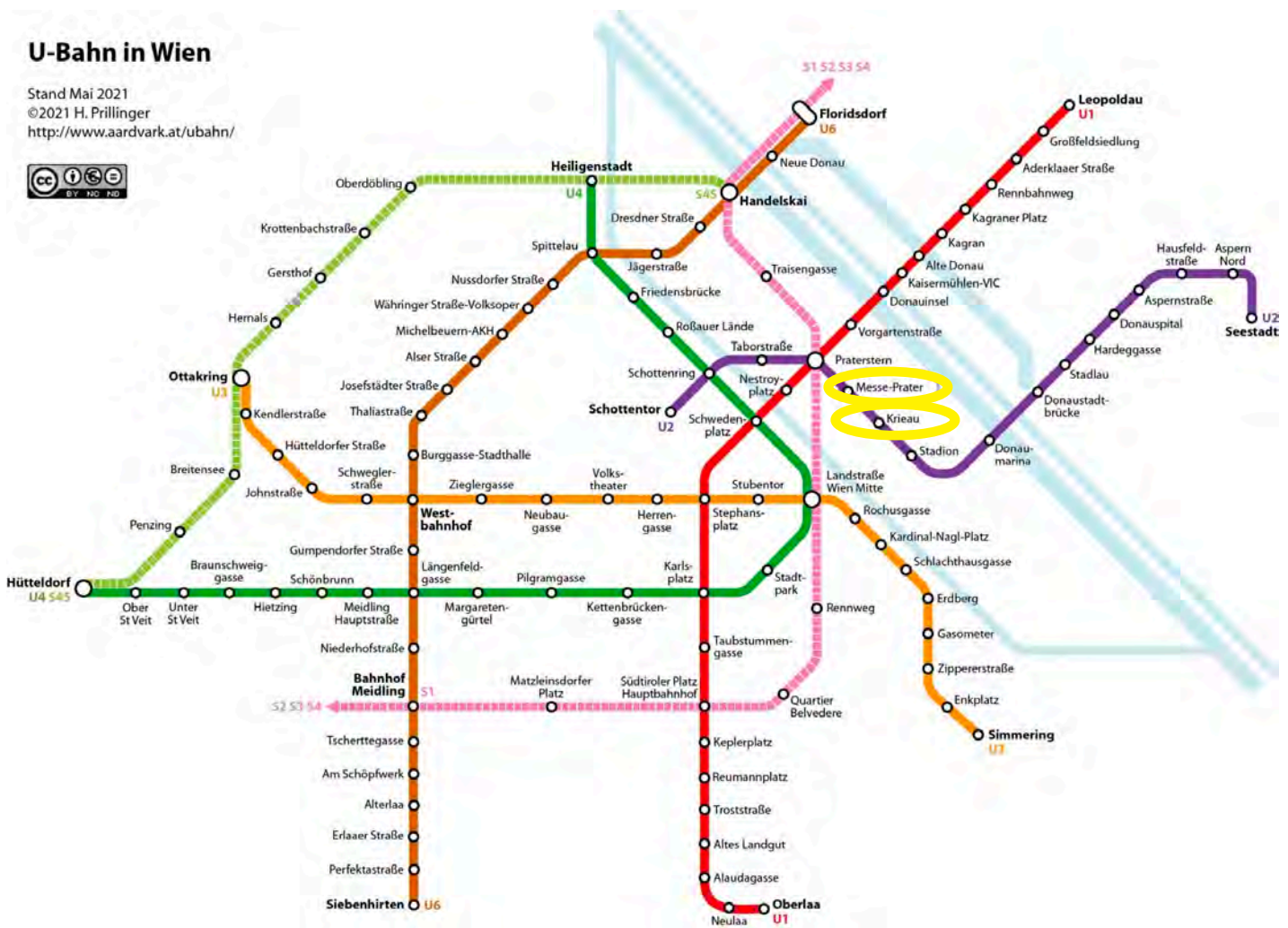
Conference name badges

The badge pick-up is possible on **Tuesday 19th at the welcome reception** (from **19:00** to **22:00**) and on **Wednesday 20th and Thursday 21st** at the **conference registration desk** at the conference venue. The registration desk is located in front of the Audimax (see map below) and is open **from 8:15 to 13.00**. Outside of these times, please send an email to escan2022.psychologie@univie.ac.at to schedule an individual meeting with our staff.

Pre-registration for the conference is required (registration on-site will not be possible). Attendees are kindly asked to wear the conference badge at all times during the conference. Your conference badge will be necessary for admission to all conference events.

If you registered for the conference dinner at the Badeschiff, you will receive an additional harm-band together with the name badge.

TC = Teaching Center

Internet access

Wi-Fi will be available throughout the venue.
This network is "wu-conference":
username: wu0028, password: c2$WayuAj7
Access via eduroam is also possible.

Social media

You can follow us on twitter: @escan2022
We appreciate tweets about the conference.
Use the hashtag: #ESCAN2022

Mobile app

The Conference4me smartphone app provides you with the most comfortable tool for planning your participation in ESCAN 2022. Browse the complete program directly from your phone or tablet and create your very own agenda on the fly.
The app is available for **Android**, **iOS** and **Windows Phone** devices.
To download the mobile app, click here or type 'conference4me' in Google Play, iTunes App Store or Windows Phone Store. You will then need to locate the conference (search for ESCAN) within the App, and "add it" to your conferences within the App.

Coffee cups

You will be given a reusable cup from the local startup "**mycoffeecup**" (link to https://www.mycoffeecup.at/) for the beverages served at the complimentary coffee breaks. Please bring this cup with you to the conference, and re-use it all five coffee breaks. You can keep the cup after the conference, and continue using it back home – or return it at the registration desk, so it can ultimately be reused by others. If all of us cooperate in this, we may avoid the waste of up to 3000 single use cups!

COVID-19 rules

Considering that the number of infections are rising again, we strongly suggest that **all attendees wear FFP2 masks as much as possible**, but foremost in the lecture halls, at the poster session, during the coffee breaks, and during the social events. Speakers at symposia and oral sessions at their own discretion can take their masks off when presenting.

No proof of vaccination or recovery is required, but please monitor your health status. Should you notice clear symptoms of a COVID-19 infection please abstain from attending the conference. In Vienna you can easily get tested at any pharmacy.

If you are not be able to attend the conference on the day your talk or poster is scheduled, visit this link

Presentation guidelines

For detailed info please refer to our website.

SYMPOSIA:

Each symposium is allocated a time slot of **90 minutes** sharp.
Symposium chairs are free to organize the times of the talks as preferred but are asked to strictly observe the schedule of their session to allow attendees to switch between sessions.

We advise to be in the lecture hall approx. 5 min before your session starts to set things up.

ORAL PRESENTATIONS:

Each oral presentation is allocated a time slot of **15 minutes**, including a **12-minute presentation**

and a **3-minute Q&A session**. As the time schedule is tight, we ask you to not exceed the suggested talk duration. During each oral presentation session, a member of the staff/local organizer board will be in charge of keeping the assigned time and in moderating the Q&A, together with the presenters.

We advise to be in the lecture hall approx. 5 min before your session starts to set things up.

SYMPOSIA & ORAL PRESENTATIONS:

PC computers for PowerPoint (Microsoft office version 2016) or PDF presentations are available as

part of each lecture halls' presentation system. We strongly advise you to use these PCs. We have organized a cloud repository to which presenters can upload their presentations ahead of time (further details here: https://www.escan2022.eu/participate/presentation-guidelines/).

Staff members from the local organizing committee will support you in downloading them to the

local PC. Alternatively, if you must use your own device, note that only standard HDMI connection can be guaranteed on site (VGA or other connection types will not be possible), and that if you have special technical requirements, you need to bring your own adapters. Make sure ahead of time that you can connect your device appropriately and that your presentation plays correctly!

POSTER PRESENTATIONS:

Posters should be in portrait orientation with a size of A0.

Please note the **ID number** associated with your poster submission in conftool (as well as in the

online and PDF program) as it will be indicated on your poster board. Material to mount the poster will be available on-site. Please do not use materials other than the ones provided!

If your poster is assigned to the **first poster session** (11:30 – 12:30), you can mount your poster

between 8:15 and 11:15, at your earliest convenience. Please remove the poster immediately after the session, as the space is needed for the next poster session presenters.

If your poster is assigned to the **second poster session** (16:00 – 17:00), you can mount your poster

between 12:45 and 15:45, at your earliest convenience. Please remove the poster immediately after the session.

Please be present with your poster during the whole poster session.

ESCAN2022 goes green! 🌿

The many attendees of ESCAN2022 clearly show that we, as a scientific community, want to see, talk and connect to each other again, probably more than ever.
At the same time, we know that events such as ours have a tremendous impact on the environment.
Therefore, we are trying our best to make the event as low impact as possible, foremost by reducing unnecessary waste to a minimum.

There will not be any printed program: everything that is essential for a worthwhile conference experience will be provided online and easily accessible, including from your phone.

No goods/merchandise will be provided by the sponsors or the organizers.

You will be given a reusable cup from the local startup "mycoffeecup" (link to https://www.mycoffeecup.at/) for the beverages served at the complimentary coffee breaks. Please bring this cup with you to the conference, and re-use it during all five coffee breaks. You can keep the cup after the conference, and continue using it back home – or return it at the registration desk or one of the mycoffecup return stations (see https://www.mycoffeecup.at/ for a map of them), so it can ultimately be reused by others. If all of us cooperate in this, we may avoid the waste of up to 3000 single use cups!

We will compensate the carbon emissions caused by the local activities of the conference to a large extent, and would like to ask you to consider doing the same for your travel-related emissions (you may want to use the Viennese University of Natural Resources' own climate mitigation initiative as well).

SOCIAL EVENTS

The conference will be opened with a welcome reception on Tuesday **July 19th**, by invitation of the **Mayor of the City of Vienna (Rathaus)**.
The welcome reception will take place in the arcade court of the beautiful Vienna city mayor hall (Rathaus).

Food and drinks will be served, and this is included in the conference fee. To find your way to the reception, you need to enter the mayor's hall via Lichtenfelsgasse 2, 1010 Vienna (note that this will be the only entrance open at that time of the day); from there follow the guidance by the staff members to find the venue. Admission starts at ~19 h and you can obtain your registration materials on site. The opening speech and welcome address are planned for ~19:30 h and the event will last until ~22 h. The event is included in the conference fee.

WELCOME RECEPTION

19/07/2022 19:00 - 22:00
Rathaus
Friedrich-Schmidt-Platz 1,
1010 Vienna

Photo by Jacek Dylag on Unsplash.

The International Association for the Study of Affective Touch (IASAT) is organising a Social Event during ESCAN 2022 in Vienna, **8.30pm on 20th of July at Zoku Hotel**.
If you are an IASAT member, or interested in affective touch, please register here (free, but places are limited) and join us for an informal, social event! There will be some nibbles and drinks, and you can also order more.
The IASAT Executive Board

IASAT SOCIAL EVENT

20/07/2022 20:30
Zoku Hotel,
Perspektivstraße 6,
1020 Vienna

On **Thursday July 21st** the European Society for Social and Affective Neuroscience (ESSAN) will have an informal and informational gathering. ESSAN gathers scientists dedicated to promoting the field of social and affective neuroscience in Europe and beyond, and offers a platform to share and critically discuss scientific ideas and methods in these fields. The current president, Frank Van Overwalle, will introduce you to the aim of the society, and you can mingle with existing members and decide to become a member yourself (which is free of charge). The meeting will take place in **room TC.5.01, on the 5th floor of the conference venue, from ~11:30 to 12:30 h**. Some snacks and non-alcoholic drinks will be served.

ESSAN RECEPTION

21/07/2022 11:30 - 12:30
Teaching Center,
Campus WU,
Room TC.5.01

CONFERENCE DINNER

21/07/2022 20:00
Wiener Badeschiff
Franz-Josefs-Kai 4,
1010 Vienna

On **Thursday 21th**, there will be an optional social event including dinner, drinks and party, at the **Wiener Badeschiff**. This is a both hip and socially responsible location. It is a ship docked on the Danube canal featuring an open sky deck and a swimming pool.

Food catering will be done by a non-profit initiative hosting cooks with refugee background (Speisen ohne Grenzen). The Badeschiff is easily reached by public transport, subway lines U1 and U2, stop Schwedenplatz, and a short walk (5 min). We will have an exclusive area reserved for us, including the pooldeck and poolbar. You can also bring your swimwear as the Badeschiff hosts a small open sky pool (not included, small extra charge). A delicious three course menu and drinks (aperitif, beer, wine, water, juices) will be served until the tap is used up (extra drinks can be purchased at own costs).

The social event starts at **20:00** and will last as long as people enjoy it (the ship closes at 1 pm though) – but feel free to come earlier and explore the whole venue.

The social event is booked out.

Photo by Markos Mant on Unsplash.

SCIENTIFIC PROGRAM

KEYNOTE LECTURE I

Wednesday July 20th
9:00 - 10:00

Room:
TC.0.10 Audimax

Dr. Rebecca Lawson

University of Cambridge

Learning under uncertainty: computation, pharmacology, and neurodevelopment

Adaptive behaviour rests on the ability to build expectations of the environment and to respond flexibly when changes are perceived to occur. Seminal theoretical accounts suggest that the noradrenaline system is crucially involved in the ability to estimate change, and that differences in learning to build expectations might underlie some of the cardinal features of neurodevelopmental disorders such as autism. In this talk I will first present a general Bayesian account of autism that rests upon differences in how sensory uncertainties are processed. I will then present a series of empirical studies using computational modelling and psychopharmacology to understand how we learn under uncertainty in neurotypical and autistic populations. The talk will conclude with some recent work from my lab investigating learning under uncertainty in infancy, to better understand the typical developmental trajectory of this fundamental ability.

Bio: Dr. Rebecca Lawson is an Assistant Professor and Wellcome Trust Henry Dale Fellow at the University of Cambridge. She is interested in how the brain represents and responds to uncertainty, and her lab uses computational models, psychopharmacology, and neuroimaging to investigate this fundamental process in health, development, and disorder.

Thursday July 21st
9:00 - 10:00

Room:
TC.0.10 Audimax

Dr. Mortem Kringelbach

University of Oxford

The well-balanced brain: Lessons from hedonia and eudaimonia

Over the last two decades, a causal understanding has emerged of the brain's pleasure system essential for survival. Reviewing the evidence, I show how this serves as a cornerstone for the well-balanced brain and can help make progress in understanding the brain's orchestration of eudaimonia, flourishing and the life well-lived. This depends on how sweet anticipation and prediction are central to extracting meaning from our environment. In fleeting moments this may translate into both pleasure and pain, which over longer timescales can give rise to flourishing and suffering, providing meaning and purpose to life.

However, given that the brain is always in non-equilibrium, a deeper understanding requires a new approach. Drawing on progress in field of complex systems, I will discuss how our recent theory of the thermodynamics of mind provides a novel, unifying whole-brain modelling framework for understanding how the brain orchestrates hedonia and eudaimonia. Ultimately, this may provide new insights into tailoring interventions to promote thriving and how best to rebalance the brain in health and disease.

Bio: Dr. Morten L. Kringelbach is the founding director of the interdisciplinary Centre for Eudaimonia and Human Flourishing at Linacre College, University of Oxford, UK. He is also a Principal Investigator at Center for Music in the Brain, University of Aarhus, Denmark. His prizewinning research has helped elucidate the brain systems driven by hedonic and eudaimonic stimuli such as, for example, infants, food, psychedelics and music. He has published fourteen books, and over 350 scientific papers, chapters and other articles and his research features regularly in newspapers, magazines, radio and television.

KEYNOTE LECTURE III

Friday July 22nd
9:00 - 10:00

Room:
TC.0.10 Audimax

Dr. Stefanie Höhl

University of Vienna

Getting attuned: Social rhythms and synchrony in early human development

Caregiver-infant interactions are characterized by interpersonal rhythms at different timescales, from nursery rhymes and interactive games to daily routines. These rhythms make the social environment more predictable for young children and facilitate interpersonal biobehavioral synchrony with their caregivers. In adults, the brain rhythms of interaction partners entrain to communicative rhythms, including speech, supporting mutual comprehension and communication. I will present recent evidence that this is also the case in the infant brain, especially when babies are addressed directly by their caregiver through infant-directed speech in naturalistic interactions. Through using simultaneous measures of neural and physiological rhythms, e.g., dual-fNIRS and dual-ECG, from caregiver and infant during live face-to-face interactions, we can further deepen our understanding of early interactional dynamics and their reciprocal nature. I will present our recent research identifying factors supporting the establishment of caregiver-infant neural synchrony, such as affectionate touch and vocal turn-taking. I will further discuss the functional links and dissociations between caregiver-infant synchrony on the neural and physiological levels. Both aspects of social synchrony are enhanced in a face-to-face interaction compared to non-interactive contexts. Yet, in contrast to neural synchrony, physiological synchrony between caregiver and infant is primarily related to infant affect. I will outline potential implications of this work and point out important future directions.

Bio: Dr. Stefanie Höhl is a Professor of Developmental Psychology at the University of Vienna, and heads the Research Unit of Developmental Psychology and the Wiener Kinderstudien lab. Her research focuses on social and cognitive development in early childhood.

ESCAN young investigator award lecture

Thursday July 21th
12:45 - 14:15

Room:
TC.0.10 Audimax

Dr. Camilla Nord

University of

Cambridge

The role of homeostatic neural and cognitive mechanisms in mental health conditions

To survive, organisms maintain homeostasis by predicting, detecting, and regulating their internal state. Many neuropsychiatric disorders show profound disruptions in homeostatic processes, including in motivational drive, appetite, and interoception. The neurocognitive basis of homeostatic processes may represent an important target of current or putative mental health treatments. This talk will discuss three recent attempts to uncover the role of homeostatic mechanisms in mental health symptoms and their treatment using experimental medicine, psychopharmacology, and functional neuroimaging. It will also outline a conceptual model of mental health treatment development, focusing on how measures from cognitive neuroscience could be clinically useful, and the current challenges in realising this translational potential.

Bio: Dr. Camilla Nord leads the Mental Health Neuroscience Programme at the University of Cambridge, MRC Cognition and Brain Sciences Unit. She is also Fellow and Director of Studies in Psychological and Behavioural Sciences at Christ's College Cambridge. Her lab investigates the neural, cognitive, and computational mechanisms of neuropsychiatric disorders, with the aim of translating techniques and models from neuroscience to clinical applications in mental health. She studied Physiology and Psychology at Magdalen College, Oxford as an undergraduate before completing her doctorate at the Institute of Cognitive Neuroscience, University College London. After postdoctoral training at the University of Cambridge, she was appointed an MRC Programme Leader Track Scientist in 2021. Her work is currently funded by the Medical Research Council (MRC), AXA Research Trust, and the National Institute of Health Research (NIHR), and she has recently been named a Rising Star by the Association for Psychological Science.

ESCAN young investigator award lecture

Thursday July 21th 12:45 - 14:15

Room: TC.0.10 Audimax

Dr. Emiel Cracco

Ghent University

Social neuroscience beyond the dyad – How does social perception scale up from one to many?

We live in a complex social world. Navigating ourselves in this world critically requires us to process, interpret, and respond to the actions of the people we encounter. Importantly, we rarely see those people in isolation. Yet, surprisingly, almost all research on social perception has studied how we process the actions of individuals. In my talk, I will address this gap by scaling up research on social perception from one to many. More specifically, I will discuss behavioral and neuroimaging (fMRI, TMS, and EEG) studies showing that in situations with multiple agents, we simultaneously track the different agents' actions not only in visual but also in motor areas of the brain. Building from this, I will then discuss what happens if the actions performed by these agents are actions that we cannot simultaneously execute and will end by discussing if, in addition to the agents' actions, we also represent the relationships between their actions. Together, this research provides important new insights into how the brain is able to deal with the vast complexity of social life with seemingly no effort.

Bio: Dr. Emiel Cracco is a senior postdoctoral research fellow of the Research Foundation Flanders (FWO), working in Ghent University, Belgium. He uses a variety of methods, including fMRI, TMS, and EEG, to study how we process other people's actions, especially in group settings.

Tuesday 19/07/2022	
09:00	The Neurobiological Basis of Human Social Behavior A Symposium in Honour of Christoph Eisenegger *Main University building (Hauptgebäude) - BIG Hörsaal*
17:45	
18:00	Opening Reception *Vienna City Mayor Hall (Rathaus) - Arkadenhof*
21:00	

The Neurobiological Basis of Human Social Behavior
A Symposium in Honour of Christoph Eisenegger

July 19th 9:00-17:45 Main University building, BIG Hörsaal

The current and alumni members of Christoph Eisenegger's lab, as well as their collaborators will present their work on a wide range of topics related to the neurobiology and psychopharmacology of social decision making.

Attendance of the symposium is FREE. Registration required:
https://nbu2022.univie.ac.at/

9:00	Registration opens
9:30 – 10:00	Welcome & opening remarks
10:00 – 11:15	Session I: Testosterone & prosocial behaviour (Hana Kutlikova, Yin Wu, Michael Naef)
11:15 – 11:35	Coffee Break
11:35 – 12:50	Session II: Hormones, reward & social dominance (Jean-Claude Dreher, Shawn Geniole, Sebastijan Veselic)
12:50 – 14:50	Lunch Break
14:50 – 16:05	Session III: Neuromodulators of social decision-making (Nace Mikus, Boris Quednow, Giorgia Silani)
16:05 – 16:25	Coffee Break
16:25 – 17:40	Session IV: The social brain (Lisa Rosenberger, Jack van Honk, Bettina Studer)
17:40	Closing remarks (Claus Lamm)

Location: Main University building (Hauptgebäude), BIG Hörsaal, Universitätsstraße 1, 1010 Vienna

BIG Hörsaal lecture hall

09:00	Keynote Lecture I: Rebecca Lawson *TC.0.10 Audimax*			
10:00	SYMPOSIUM My inner feelings vs. yours: the role of interoception on the "me-not me" distinction *TC.5.01 Hörsaal* Chair(s): Loiuse P. Kirsche, Mariana von Mohr	SYMPOSIUM Mutual adaptation in collaborative tasks: an integrative approach to understand human-human interactions *TC.5.03 Hörsaal* Chair(s): Francesca Ciardo, Lucia Maria Sacheli	SYMPOSIUM New directions on the social and emotional cerebellum *TC.5.05 Hörsaal* Chair(s): Frank Van Overwalle	SYMPOSIUM The utility of neuroscience in sustainability and climate change research: The emerging field of environmental neuroscience *TC.5.13 Hörsaal* Chair(s): Kimberly C. Doell	SYMPOSIUM Domain-general building blocks of social interactions *TC.5.15 Hörsaal* Chair(s): Shir Atzil, Yuval Hart
11:30 **12:30**	Poster Session & Coffee Break *TC.2.07-11-13-15 Lernzone*			
13:00	ORAL PRESENTATIONS Artificial agents *TC.5.01 Hörsaal*	ORAL PRESENTATIONS Autistic Spectrum Disorders *TC.5.03 Hörsaal*	ORAL PRESENTATIONS Virtual and real body perception *TC.5.05 Hörsaal*	ORAL PRESENTATIONS Decision making *TC.5.13 Hörsaal*	ORAL PRESENTATIONS Emotion and face perception *TC.5.15 Hörsaal*
14:30	SYMPOSIUM The righteous choice: The neurocognitive and neurocomputational mechanisms underlying moral conflict and social decision-making *TC.5.01 Hörsaal* Chair(s): Helena Hartmann, Judit Campdepadros	SYMPOSIUM Emotion and proprioception – Taking a fresh look with a wider scope and new methodological advances *TC.5.03 Hörsaal* Chair(s): Sebastian Korb	SYMPOSIUM New challenges and frontiers in interoceptive research *TC.5.05 Hörsaal* Chair(s): Laura Crucianelli, Esra Al	SYMPOSIUM Emerging multi-disciplinary perspectives and cutting-edge advancements in dance neuroaesthetics *TC.5.13 Hörsaal* Chair(s): Kohinoor Monish Darda, Andrea Orlandi	SYMPOSIUM Social connection & the nose: How human chemosignals contribute to wellbeing *TC.5.15 Hörsaal* Chair(s): Cinzia Cecchetto, Valentina Parma
16:00	Poster Session & Coffee Break *TC.2.07-11-13-15 Lernzone*			
17:00	ORAL PRESENTATIONS Empathy *TC.5.01 Hörsaal*	ORAL PRESENTATIONS Social perception *TC.5.03 Hörsaal*	ORAL PRESENTATIONS Interoception *TC.5.05 Hörsaal*	ORAL PRESENTATIONS Language, memory and navigation *TC.5.13 Hörsaal*	ORAL PRESENTATIONS Stress *TC.5.15 Hörsaal*
18:30 **20:00**	SYMPOSIUM The amygdala's role in affective and social learning *TC.5.01 Hörsaal* Chair(s): Ronald Sladky, Wulf Haubensak	SYMPOSIUM Understanding the moral compass: Individual variation in moral behaviour from a behavioural neuroscientific perspective *TC.5.03 Hörsaal* Chair(s): Aiste Ambrase, Giuseppe Ugazio	SYMPOSIUM Beyond simple cost-benefit trade-offs: Integrative computations that shape effort allocation *TC.5.05 Hörsaal* Chair(s): Dennis Hernaus, Eliana Vassena	SYMPOSIUM Context-dependent touch: How the brain interprets the body and world to guide behavior *TC.5.13 Hörsaal* Chair(s): Konstantina Kilteni, Luke E. Miller	SYMPOSIUM The World is your Lab - The opportunities and challenges of real-world data collection *TC.5.15 Hörsaal* Chair(s): Cesco Willemse, Magda Mustile, Agnieszka Wykowska
20:30 **22:00**	IASAT Social Event *Zoku Hotel*			

WEDNESDAY 20/07/2022
PARALLEL SESSIONS

SYMPOSIUM
My inner feelings vs. yours: the role of interoception on the "me-not me" distinction
Time: Wednesday, 20/07/2022: 10:00 – 11:30
Room: TC.5.01 Hörsaal

Interactions between interoception and perspective-taking: Current state of research and future directions
Louise P Kirsch, Chiara Baiano, Xavier Job, Malika Auvray

Breathe in breathe out: respiratory phases specifically affect the neural monitoring of internal signals
Francesca Ferri, Andrea Zaccaro, Marcello Costantini, Mauro Gianni Perrucci

The interoceptive side of the self-other distinction: neuropsychological and developmental studies
Aikaterini Fotopoulou

Interacting hearts: the role of interoception on emotional egocentric bias and social influence
Mariana von Mohr, Gianluca Finotti, Valerio Villani, Bahador Bahrami, Manos Tsakiris

SYMPOSIUM
Mutual adaptation in collaborative tasks: an integrative approach to understand human-human interactions
Time: Wednesday, 20/07/2022: 10:00 – 11:30
Room: TC.5.03 Hörsaal

Individual differences in temporal adaptation and anticipation during real-time interpersonal coordination
Peter E. Keller

Self-other neural processes underlying interpersonal synchronisation through sound
Manuel Varlet, Sylvie Nozaradan, Peter E. Keller

Joint actions with humanoid robotsdevelopmental studies
Francesca Ciardo, Davide De Tommaso, Agnieszka Wykowska

Crazy for you! Cognitive processes supporting the decisions for joint action
Arianna Curioni

How shared goals shape action monitoring
Lucia Maria Sacheli, Margherita Adelaide Musco, Eraldo Paulesu

SYMPOSIUM
New directions on the Social and Emotional Cerebellum
Time: Wednesday, 20/07/2022: 10:00 – 11:30
Room: TC.5.05 Hörsaal

A functional atlas of the cerebellum based on neurosynth task-coordinates
Frank Van Overwalle, Qianying Ma, Naem Haihambo, Tom Bylemans, Beatriz Puerta Catoira, Mahyar Firouzi, Meijia Li, Min Pu

Functional topography of the cerebellum in response to the comprehension of others' emotional states: a TMS study
Andrea Ciricugno, Chiara Ferrari, Maria Arioli, Zaira Cattaneo

The posterior cerebellum helps process concepts about social relationships
Haroon Popal, Katie Jobson, Yin Wang, Mark A. Thornton, Ingrid R. Olson

Emerging evidences on the social role of the human cerebellum: from cerebellar disease to psychiatric and neurodevelopmental disorders.
Libera Siciliano, Giusy Olivito, Maria Leggio

Social thinking is for doing: The posterior cerebellum supports prediction of social actions based on personality traits
Naem Haihambo, Qianying Ma, Frank Van Overwalle

SYMPOSIUM
The utility of neuroscience in sustainability and climate change research: The emerging field of Environmental Neuroscience
Time: Wednesday, 20/07/2022: 10:00 – 11:30
Room: TC.5.13 Hörsaal

The neural correlates of daily sustainable and unsustainable behavior
Kimberly C. Doell, Tobias Brosch

From imagining to acting your pro-ecological self: insight from brain mechanisms underlying prospective thinking of pro-environmental behaviors
Damien Brevers

Individual differences in intergenerational sustainable behavior are associated with cortical thickness in DMPFC and DLPFC.
Emmanuel Guizar Rosales, Thomas Baumgartner, Daria Knoch

How nature-exposure may be important for regulating brain activity in response to emotions
Simone Grassini

Testing the effects of physical environments on the human brain
Simone Kühn

SYMPOSIUM
Domain-general building blocks of social interactions
Time: Wednesday, 20/07/2022: 10:00 – 11:30
Room: TC.5.15 Hörsaal

Social regulation of allostasis is a mechanism for bonding
Shir Atzil

Early warning signals in motion inference
Yuval Hart

Expectations and social experience in health and disease
Lorena Chanes

The role of nociceptive brain regions in emotional contagion and danger detection
Christian Keysers

PARALLEL SESSIONS

ORAL PRESENTATIONS
Artificial agents
Time: Wednesday, 20/07/2022: 13:00 – 14:30
Room: TC.5.01 Hörsaal

Domain-specific and domain-general neural network engagement during human-robot interactions
Ann Hogenhuis, Ruud Hortensius

Joint Sense of Agency in Human-Human and Human-Robot Interaction
Uma Prashant Navare, Kyveli Kompatsiari, Francesca Ciardo, Agnieszka Wykowska

The interplay of human-likeness and intentionality attribution for vicarious sense of agency over humanoid robot actions
Cecilia Roselli, Francesca Ciardo, Davide De Tommaso, Agnieszka Wykowska

Exploring the relationship between aesthetic appreciation and stimulus and knowledge cues to human animacy
Kohinoor Monish Darda, Aaron Maiwald, Emily S Cross

Identifying with an avatar face changes mental representation of one's real face
Mateusz Wozniak, Lara Maister, Kassandra Friebe, Guenther Knoblich

ORAL PRESENTATIONS
Autistic Spectrum Disorders
Time: Wednesday, 20/07/2022: 13:00 – 14:30
Room: TC.5.03 Hörsaal

Facial expression predictions in autism
Marta Robles, Irene Ramos-Grille, Amaia Hervás, Enric Duran-Tauleria, Christine M. Falter-Wagner, Lorena Chanes

Single-strand DNA-binding protein SSBP3 is a main neurodevelopmental driver in 1p32.3 microdeletion/microduplication syndrome
Hyung-Goo Kim, Mi-Sun Lee, Ho Yeon Lee, Vijay Gupta, Afif Ben-Mahmoud, Hyun-Taek Kim, Reinhard Ullmann, Robin Williamson, Bertrand Isidor, Alysia Kern Lovgren, Melanie O'Leary, Christina Austin-Tse, Anna C.E. Hurst, Natasha L. Rudy, Orrin Devinsky, Gemma Poke, Moira Blyth, Arie van Haeringen, Claudia Ruivenkamp, Elizabeth A. Jones, Frederic Tran-Mau-Them, Solene Conrad, Kate Robertshaw, Katherine Neas, Tiong Yang Tan, Lynn Pais, Mathilde Nizon, Benjamin Cogne, Tarachandra Narumanchi, Nicole Matthews, Aditi Parikh, Grace Noh, Malia Brown, George Anadiotis, Kari Magnussen, Vanessa Suckow, Jessica Gibbons, Yves Lacassie, Woo-Yang Kim, Chong Ae Kim, Cynthia C Morton, Lawrence C Layman, Makoto Yoshino, Ingo Kurth, Vera M Kalscheuer, Cheol Yong Choi, Cheol-Hee Kim, James F Gusella

Social attention and social reinforcement learning – a naturalistic eye tracking paradigm and computational modelling of responses to emotional point-light-displays (PLD's)
Raimund Buehler, Giorgia Silani

The physiological correlates of social space dysregulation in children with autism
Michela Candini, Gianmarco Mellini, Simone Battaglia, Virginia Giuberti, Giuseppe di Pellegrino, Francesca Frassinetti

Wanting and liking of affiliative touch and food rewards in autism spectrum disorder: A simultaneous fMRI and facial EMG study
Emilio Chiappini, Claudia Massaccesi, Sebastian Korb, David Steyrl, Matthäus Willeit, Giorgia Silani

ORAL PRESENTATIONS
Virtual and Real Body Perception
Time: Wednesday, 20/07/2022: 13:00 – 14:30
Room: TC.5.05 Hörsaal

Body Ownership and the Neural Processes of Memory Encoding and Reinstatement
Heather Iriye, H. Henrik Ehrsson

Feeling at home in a virtual body; Neural, behavioral, and phenomenal effects of the illusory embodiment of the desired body in Body Integrity Dysphoria
Gianluca Saetta, Yannik Peter, Kathy Ruddy, Jasmine Ho, Lars Michels, Bigna Lenggenhager

Resting-state EEG predicts learning slope during virtual tool-use training in augmented reality and associated changes of body schema in healthy ageing
Amir Jahanian Najafabadi, Dennis Küste, Felix Putze, Ben Godde

Stand up for your brain: The effect of body posture on arousal, effort, and executive functions
Henk Van Steenbergen

The dynamic experience of arousing architectures influences the perception of emotional body postures: an EEG study in virtual reality

Paolo Presti, Gaia Maria Galasso, Pietro Avanzini, Fausto Caruana, Davide Ruzzon, Giovanni Vecchiato

ORAL PRESENTATIONS
Decision making
Time: Wednesday, 20/07/2022: 13:00 – 14:30
Room: TC.5.13 Hörsaal

Coordination effort in joint action is reflected in pupil size
Basil Wahn, Veera Ruuskanen, Alan Kingstone, Sebastiaan Mathôt

Partner choice in motion
Luke John McEllin, Natalie Sebanz

Risk and the body: Different risk taking profiles characterise restrictive eating and acceptance of cosmetic surgery
Paul Mark Jenkinson, Athanasios Koukoustakis, Aikaterini Fotopoulou

Uncertainty deconstructed: a scoping review on the ERP correlates of risk and ambiguity
Catarina Botelho, Carina Fernandes, Carlos Campos, Carlos Seixas, Fernando Barbosa, Fernando Ferreira-Santos, João Marques-Teixeira, Rita Pasion, Tiago O. Paiva

Acute stress influences decisions based on social and reward inference
Stefan Schulreich, Lars Schwabe

ORAL PRESENTATIONS
Emotion and face perception
Time: Wednesday, 20/07/2022: 13:00 – 14:30
Room: TC.5.15 Hörsaal

Beware of this person! Psychophysiological responding to instructed and reversed threat persons
Florian Bublatzky, Inga Niedtfeld, Christian Schmahl

Cognitive demand drives dorsolateral prefrontal cortex activity during emotion recognition
Simon Kirsch, Natalie Minix, Simon Maier, Muyu Li, Simón Guendelman, Isabel Dziobek, Ludger Tebartz van Elst

Does representational momentum for dynamic emotional faces differ between happiness and anger? Preliminary results of a mnesic probe task
Joana Grave*, Sara Cordeiro*, Nuno de Sá Teixeira, Sebastian Korb, Sandra Cristina Soares

Emotion–not credibility–determines the cognitive effort invested in processing social misinformation
Julia Baum, Romy Frömer, Rasha Abdel Rahman

The facilitating effect of maternal odor on rapid face categorization in the infant brain: A progressive decline over the first year
Diane Rekow, Jean-Yves Baudouin, Anna Kiseleva, Bruno Rossion, Karine Durand, Benoist Schaal, Arnaud Leleu

PARALLEL SESSIONS

SYMPOSIUM
The righteous choice: The neurocognitive and neurocomputational mechanisms underlying moral conflict and social decision-making
Time: Wednesday, 20/07/2022: 14:30 – 16:00
Room: TC.5.01 Hörsaal

Ageing is associated with disrupted reinforcement learning whilst learning to help others is preserved
Jo Cutler, Marco Wittmann, Ayat Abdurahman, Luca Hargitai4, Daniel Drew, Masud Husain, Patricia Lockwood

A causal role of temporoparietal junctions in computing social influence during goal-directed learning
Lei Zhang, Farid I. Kandil, Claus C. Hilgetag, Jan Gläscher

Anxiety suppresses activity related to belief-inferences during economic games in left temporoparietal junction
Jan B. Engelmann, Li-Ang Chang

Neural and computational mechanisms of prosocial and self-benefitting effort
Patricia L. Lockwood, Marco Wittmann, Hamed Nili, Mona Matsumoto-Ryan, Ayat Abdurahman, Jo Cutler6, Masud Husain, Matthew A. J. Apps

The ongoing quest to decipher the deciding brain
Helena Hartmann, Judit Campdepadros

SYMPOSIUM
Emotion and proprioception – taking a fresh look with a wider scope and new methodological advances
Time: Wednesday, 20/07/2022: 14:30 – 16:00
Room: TC.5.03 Hörsaal

Do facial responses contribute to the processing of authenticity in auditory emotions?
César Lima

Putting sensorimotor simulation on the spot: Degeneracy in neural networks and sensorimotor-visual integration in facial expression processing
Paola Sessa, Arianna Schiano Lomoriello, Thomas Quettier, Pier Francesco Ferrari

Using neuromuscular electric stimulation (NMES) to study social cognition
Sebastian Korb, Themis Efthimiou, Arthur Elsenaar, Marc Mehu

Tuning emotional face perception with facial neuromuscular electrical stimulation (NMES)
Themis Efthimiou, Marc Mehu, Arthur Elsenaar, Sebastian Korb

Effects of the mu-opioid receptor agonist morphine on facial mimicry and emotion recognition
Claudia Massaccesi, Sebastian Korb, Matthaeus Willeit, Boris B. Quednow, Giorgia Silani

SYMPOSIUM
New challenges and frontiers in interoceptive research
Time: Wednesday, 20/07/2022: 14:30 – 16:00
Room: TC.5.05 Hörsaal

The measurement of interoception: challenges and novel methods
Jennifer Murphy

An interoceptive take on touch and temperature
Laura Crucianelli

Cardiac signals impact somatosensory perception and motor activity
Esra Al

Interoceptive training reduces anxiety and enhances interoceptive accuracy and insula connectivity
Sarah Garfinkel

SYMPOSIUM
Emerging multi-disciplinary perspectives and cutting-edge advancements in dance neuroaesthetics
Time: Wednesday, 20/07/2022: 14:30 – 16:00
Room: TC.5.13 Hörsaal

Is dance appreciation universal? The role of representation, expertise, and culture in aesthetic responses to Indian and Western classical dance.
Kohinoor Monish Darda, Emily S Cross

Experts feel it all: Brain- heart interplay and the role of dance expertise on facial emotion expression and interoception
Vasiliki Meletaki, Bettina Forster, Beatriz Calvo-Merino

Cross-cultural empirical aesthetics of dance
Julia F. Christensen, Shahrzad Khorsandi

Interpersonal complexity in dance aesthetics: the role of objective and subjective features
Andrea Orlandi, Matteo Candidi

Shared brain activity in large groups while watching live dance: A mobile-EEG Hyperscanning study.
Laura Rai, Haeeun Lee, Federico Calderon, Jamie Ward, Guido Orgs

SYMPOSIUM
Social connection & the nose: how human chemosignals contribute to wellbeing
Time: Wednesday, 20/07/2022: 14:30 – 16:00
Room: TC.5.15 Hörsaal

Children's body odours in the parent-child relationship - signals of kinship and affection
Laura Schäfer

There is Chemistry in Social Chemistry
Inbal Ravreby

Chemical communication of positive emotions in humans
Camille Ferdenzi, Stéphane Richard, Olivia Carlos, Aline Robert-Hazotte, Bénédicte Race, Moustafa Bensafi

Learning to see faces with the nose
Arnaud Leleu

Emotional body odors processing in social anxiety and depression

Elisa Dal Bò, Claudio Gentili, Francesca Mura, Alejandro Luis Callara, Luca Citi, Nicola Vanello, Enzo Pasquale Scilingo, Alberto Greco, Cinzia Cecchetto

PARALLEL SESSIONS

ORAL PRESENTATIONS
Empathy
Time: Wednesday, 20/07/2022: 17:00 – 18:30
Room: TC.5.01 Hörsaal

Empathy for pain and aggression among young adult men and women: an EEG Study
Celia Francisca Camara Perez-Vera, Alejandra De Sel, Arkadij Lobov

I see you: Seeing one's partner in online emotional communication enhances the perceptions of togetherness, being heard, and empathy
Shir Genzer, Yonat Rum, Anat Perry

Investigating the Relationships between Empathy and Executive Functions in Early Adolescents
Noam Mairon, Lior Abramson, Ariel Knafo-Noam, Anat Perry, Mor Nahum

Reduced affective Empathy in Women on Oral Contraceptives: a cross-sectional fMRI Study
Ann-Christin Sophie Kimmig, Dirk Wildgruber, Anna Gärtner1, Bernhard Drotleff, Marina Krylova, Michael Lämmerhofer, Inger Sundström-Poromaa, Birgit Derntl

The interplay between psychopathy, antisocial behaviour, and empathy: meta-analytical evidence across different conceptual frameworks
Carlos Campos, Rita Pasion, Andreia Azeredo, Eduarda Ramião, Prune Mazer, Inês Macedo, Fernando Barbosa

ORAL PRESENTATIONS
Social perception
Time: Wednesday, 20/07/2022: 17:00 – 18:30
Room: TC.5.03 Hörsaal

Attention allocation in complementary joint action: how joint goals affect spatial orienting
Laura Schmitz, Basil Wahn, Melanie Krüger

Perceptions of others' social affect and social cognition influences prosocial behavior
Leticia Micheli, Christina Breil, Anne Böckler

Sexualization: the Role of Attentional Biases, (Dis)similarity and Animalistic and Mechanistic Dehumanisation
Melanie Michna

Social interaction matters: Human behavior and cognition beyond the individual
Dimitris Bolis, Anna Ciaunica, Leonhard Schilbach

Tuning gaze cueing via socio-contextual factors
Mario Dalmaso, Xinyuan Zhang, Giovanni Galfano, Luigi Castelli

ORAL PRESENTATIONS
Interoception
Time: Wednesday, 20/07/2022: 17:00 – 18:30
Room: TC.5.05 Hörsaal

Cardiac sympathetic-vagal activity initiates a functional brain-body response to emotional arousal
Diego Candia-Rivera, Vincenzo Catrambone, Julian F. Thayer, Claudio Gentili, Gaetano Valenza

Heart's role in visual and auditory duration perception, modulated by emotional content
Irena Arslanova, Manos Tsakiris

Respiratory phase-dependent heartbeat evoked potential modulations are associated to cardiac, but not respiratory interoceptive attention
Andrea Zaccaro, Francesca Della Penna, Mauro Gianni Perrucci, Marcello Costantini, Francesca Ferri

The perception of interoceptive signals in blind individuals
Dominika Radziun, Maksymilian Korczyk, Laura Crucianelli, Marcin Szwed, H. Henrik Ehrsson

Towards new measures of thermal interoception: estimating changes in peripheral body temperature
Alisha Vabba, Giuseppina Porciello, Marina Scattolin, Marco Spitaleri, Maria Serena Panasiti

ORAL PRESENTATIONS
Language, memory and navigation
Time: Wednesday, 20/07/2022: 17:00 – 18:30
Room: TC.5.13 Hörsaal

Are you in the mood to learn from feedback?
Frederik M. van der Veen, C. Henrico Stam

Comprehension is enhanced when the speaker's pupils are larger: pupil size and gaze direction effects on spoken language comprehension
Laura Jiménez-Ortega, María Casado-Palacios, Miguel Rubianes, Mario Martínez-Mejias, Sabela Fondevila, Jose Sanchez-Garcia, Francisco Muñoz, Pilar Casado, Manuel Martín-Loeches

Entorhinal grid-like codes and time-locked network dynamics track others navigating through space
Isabella Wagner, Luise Graichen, Boryana Todorova, Andre Lüttig, David Omer, Matthias Stangl, Claus Lamm

If it ain't coupling, it ain't clicking: impaired social working memory due to disrupted fronto-parietal coupling of brain oscillations in individuals with high autistic traits
Elisabeth V. C. Friedrich, Yannik Hilla, Paul Sauseng

The role of beta oscillations in the mental time travel
Mariano D'Angelo, Franscesca Frassinetti, Marinella Cappelletti

ORAL PRESENTATIONS
Stress
Time: Wednesday, 20/07/2022: 17:00 – 18:30
Room: TC.5.15 Hörsaal

Distal stress and the persistence of conditioned fear memories
Marta Andreatta, Christopher Klinke, Matthias Wieser, Maren Lange

Stress recovery with social support: A dyadic stress and support task
Guro Engvig Løseth, Marie Eikemo, Martin Trøstheim, Isabell M. Meier, Markus Heilig, Siri Leknes

The Effect of Stress on intuitive (Dis)Honesty
Sebastian Speer, Ana Martinovici, Smidts Ale, Maarten Boksem

Forget about it: The influence of stress on the ability to control intrusive thoughts
Conny Quaedflieg, S.M. Ashton

PARALLEL SESSIONS

SYMPOSIUM
The amygdala's role in affective and social learning
Time: Wednesday, 20/07/2022: 18:30 – 20:00
Room: TC.5.01 Hörsaal

The amygdala's role in conditioned fear – Methodological challenges and solutions for translational research
Karita Ojala, Dominik Bach

The body's guide to affective decisions
Dominic Kargl, Wulf Haubensak

Unravelling the different roles of the basolateral and central amygdala in human trust learning
Lisa Rosenberger, Ronald Sladky, Federica Riva, Claus Lamm, Jack van Honk

Social stimulus-responsive neurons in the mouse basal amygdala-nucleus accumbens pathway
Christopher Pryce

Breakdown of utilitarian moral judgement after basolateral amygdala damage
Jack van Honk, David Terburg, Estrella R. Montoya, Jordan Grafman, Dan J. Stein, Barak Morgan

SYMPOSIUM
Understanding the moral compass: individual variation in moral behaviour from a behavioural neuroscientific perspective
Time: Wednesday, 20/07/2022: 18:30 – 20:00
Room: TC.5.03 Hörsaal

Neuro-computational foundations of moral preferences
Giuseppe Ugazio, Marcus Grueschow, Rafael Polania, Claus Lamm, Philippe Tobler, Christian Ruff

The neurocomputational bases of learning to avoid another person's harm
Lukas L. Lengersdorff, Isabella C. Wagner, Patricia L. Lockwood, Claus Lamm

Who is at risk? Using the biopsychosocial model to study delinquency in adolescents
Neeltje E. Blankenstein, Samantha Bouwmeester, Sterre van Haeringen, Rowan T. van Klink, Lieke van der Meule, Lucres M.C. Jansen

A coordinate-based ALE meta-analysis on neural correlates of moral, risky and ambiguous decision-making
Aiste Ambrase, Veronika Müller, Hong Yu Wong, Birgit Derntl

SYMPOSIUM
Beyond simple cost-benefit trade-offs: integrative computations that shape effort allocation
Time: Wednesday, 20/07/2022: 18:30 – 20:00
Room: TC.5.05 Hörsaal

How the marginal value of effort shapes efficient effort allocation decisions
Ross A Otto

Modeling motivation as a meta-learning problem: the integration of effort, reward and stress
Eliana Vassena

Reward and aversive motivation influence distinct effort strategies for cognitive control allocation
Debbie M Yee

The impact of acute stress on appetitive versus aversive motivation
Dennis Hernaus

A tale of two efforts in reinforcement learning
Sara Garofalo, Francesca Starita, Gianluca Finotti, Giuseppe di Pellegrino

SYMPOSIUM
Context-dependent touch: how the brain interprets the body and world to guide behavior
Time: Wednesday, 20/07/2022: 18:30 – 20:00
Room: TC.5.013 Hörsaal

The influence of tactile information in guiding behavior in the context of self
Konstantina Kilteni

The influence of tactile information in guiding behavior in the context of tool use
Luke E. Miller

The influence of tactile information in guiding behavior in an affective context
Rochelle Ackerley

The influence of tactile information in guiding behavior in the context of illusory motion
Xaver Fuchs

The influence of tactile information in guiding behavior in the context of spatial perspective taking
Xavier Job

SYMPOSIUM
The World is your Lab - The Opportunities and Challenges of Real-World Data Collection

Time: Wednesday, 20/07/2022: 18:30 – 20:00
Room: TC.5.15 Hörsaal

Improving ecological validity in social cognition research
Kyveli Kompatsiari, Abdulaziz Abubshait, Agnieszka Wykowska

Challenges Related to the Identification and Extraction of Neural Markers of Cognitive Processes Underlying Real-World Behaviour
Simon Ladouce

Mobile EEG to Investigate Cognitive Mechanisms Underlying Locomotion in the Real-World: Feasibility and Challenges
Magda Mustile

Studies in social behaviour and cognition using wearables and theatre
Jamie A. Ward

Conversation as a Model Task for Moving Between Lab and Life
Tom Foulsham, Jessica Dawson, Astrid Priscilla Martinez Cedillo

WEDNESDAY 20/07/2022
POSTER SESSION I

Time: Wednesday, 20/07/2022: 11:30 – 12:30
Location: Lernzone (TC.2.07-11-13-15)

ID 111 - Mind your step: social cerebellum in interactive navigation
Meijia Li, Frank Van Overwalle

ID 145 - Driving behavior und event-related potentials (ERP) under visual distraction: A driving simulator study with young, middle-aged, and older drivers
Melanie Karthaus, Edmund Wascher, Stephan Getzmann

ID 147 - Unbalanced functional connectivity at rest affects the ERP correlates of affective prediction in high Intolerance of Uncertainty individuals: a high density EEG investigation.
Fiorella Del Popolo Cristaldi, Giulia Buodo, Gian Marco Duma, Michela Sarlo, Giovanni Mento

ID 151 - Bodily awareness in depersonalization-derealization disorder
L S Merritt Millman, Elaine C M Hunter, Devin B Terhune, Guido Orgs

ID 153 - The effects of mindfulness-based stress reduction on the association between autonomic interoceptive signals and emotion regulation selection
Ziv Ardi

ID 155 - Positive cognitive reappraisal is beneficial for women's but not for men's IGT decision making
Jorge Alfredo Flores Torres

ID 159 - All that meets the eye: The contribution of reward processing and pupil mimicry on pupillary reactions to facial trustworthiness
Althea Frisanco, Marco Biella, Marco Brambilla, Mariska E. Kret

ID 171 - Early Gaze direction processing: insights from ERP decoding
Domilė Tautvydaitė, Joana Chavaz, Nicolas Burra

ID 175 - Neural correlates of authentic vs. hubristic pride and shame in social context
Jose Sánchez-García, Rahele Mohallani, Laura Jiménez-Ortega, Sabela Fondevila, Pili Casado, Francisco Muñoz, Miguel Rubianes, Manuel Martín-Loeches

ID 177 - Validating an audiovisual paradigm to study the emotional egocentricity bias
Tatiana Goregliad Fjaellingsdal, Nikolas Makowka, Ulrike M. Krämer

ID 185 - Neural correlates underlying social-cue induced value change
Damiano Terenzi, Apoorva Rajiv Madipakkam, Felix Molter, Peter N. C. Mohr, Annabel B. Losecaat Vermeer, Lu Liu, Soyoung Q. Park

ID 191 - No Influence of Threat Uncertainty on Fear Generalization (N = 88)
Asimina Aslanidou, Marta Andreatta, Matthias J. Wieser

ID197 - Electrophysiological dynamics of self-identity across time
Francisco Muñoz, Miguel Rubianes, Laura Jiménez-Ortega, Sabela Fondevila, David Hernández-Gutiérrez, José Sánchez-García, Pilar Casado, Manuel Martín-Loeches

ID 352 - Take it with a grain of positivity: Anger elicitation and regulation in neurologically healthy individuals

Jade Abigail Witten, Emma Truss, Rudi Coetzer, Oliver Turnbull

ID 203 - The causal role of affect sharing in observational fear learning: A preregistered fMRI study using hypnotic suggestions
Alexa Müllner-Huber, Tibor Stöffel, Andreas Olsson, Claus Lamm

ID 205 - A neuroscience approach to prison experience: on the influence of prison on the sense of agency and empathy for pain among inmates
Elodie C. Kox, Emilie A. Caspar

ID 209 - Interoception and self-perception in Schizophrenia patients
Paula Celeste Salamone, Adam Enmalm, Reinoud Kaldewaij, Andrea Johansson Capusan, Charlotte Medley, Håkan Olausson, Rebecca Böhme

ID 217 - Neglect in temporal domain: Amelioration following a prismatic adaptation treatment and implications in everyday life. A single case study
Francesca Frassinetti, Alessandro Musetti, Barbara Magnani

ID 225 - Frontal alpha asymmetry and frontal theta power in response to adult faces varying in familiarity, gender and displayed emotion: a pilot EEG study with 6-month-olds
Alicja Brzozowska, Denis Mareschal, Matthew R. Longo, Frank Wiesemann, Teodora Gliga

ID 229 - Voluntary Control of the Amygdala Activity using Real-Time functional MRI-based Naturalistic Adaptive Neurofeedback
Apurva Watve, Amelie Haugg, Yury Koush, David Willinger, Annette Brühl, Philipp Stämpfli, Frank Scharnowski, Ronald Sladky

ID 231 - Does an empty Stomach influence the rewarding Value of Compliments?
Uta Sailer, Federica Riva, Daniela M. Pfabigan

ID 241 - Endocannabinoid and neuroendocrine contributions to fear learning in humans
Hilda Charlotta Engelbrektsson, Madeleine Jones, Raegan Mazurka, Andrea Capusan, Markus Heilig, Leah Mayo

ID 243 - Lonely in the Dark: Trauma Memory and sex-specific Dysregulation of Amygdala Reactivity to Fear Signals
Mitjan Morr, Jeanine Noell, Daphne Sassin, Jule Daniels, Alexandra Philipsen, Benjamin Becker, Birgit Stoffel-Wagner, Rene Hurlemann, Dirk Scheele

ID 245 - Exogenous estradiol and oxytocin modulate sex differences in hippocampal reactivity and episodic memory
Marie Coenjaerts, Isabelle Trimborn, Berina Adrovic, Birgit Stoffel-Wagner, Larry Cahill, Alexandra Philipsen, René Hurlemann, Dirk Scheele

ID 251 - Lonely heart in the wild: reduced real-life heart rate variability and increased negative appraisals in lonely individuals
Aleksandra Piejka, Marcelina Wiśniewska, Łukasz Okruszek

ID 257 - Neurophysiological correlates associated with processing of social interactions in young adults
Marta Chrustowicz, Szymon Mąka, Łukasz Okruszek

ID 259 - Neurophysiological markers of response to affective stimuli under cognitive reappraisal strategies
Szymon Mąka, Marta Chrustowicz, Łukasz Okruszek

ID 261 - A Framework for Joint Music Making: behavioural findings, neural processes and computational models
Sara F. Abalde, Peter E. Keller, Giacomo Novembre

ID 267 - Are neocortical reference frames necessarily representational?
Louis Longin

ID 273 - No pain, no gain: Neural correlates of effort-based decision making in anhedonia
Anna Daniels, Sarah A. Wellan, Peter N.C. Mohr, Henrik Walter

ID 277 - How does personality play a role in the emotional categorization of gendered ambiguous facial expressions?
Amandine Guillin, Laurence Chaby, Dorine Vergilino-Perez

ID 279 - P300 and autistic traits in adults: a meta-analytical approach
Prune Mazer, Helena Garcez, Inês Macedo, Rita Pasion, Celeste Silveira, Fernando Ferreira-Santos

ID 283 - Impulsive psychopathic traits increase N170 amplitudes to emotional face unpleasantness: Evidence for a hostility bias in an adolescent sample
Rita Almeida, Mariana Pereira, Rita Pasion, Helena Garcez, Prune Mazer, Fernando Barbosa, Fernando Ferreira-Santos

ID 285 - Early categorization of social affordances during the visual encoding of bodily stimuli
Ugo Giulio Pesci, Quentin Moreau, Eleonora Parrotta, Vanessa Era, Matteo Candidi

ID 287 - How can contextual cueing with face stimuli affect the performance of younger and older adults? – An event-related potential study of visual search
Zsófia Anna Gaál, Boglárka Nagy, Petia Kojouharova, István Czigler

ID 297 - Functional Connectivity as an index of subjective attitude towards robots
Serena Marchesi, Lorenzo Parenti, Francesco Bossi, Agnieszka Wykowska

ID 299 - Natural environments modulate pain: How contact to nature impacts the neural processing of pain
Maximilian O. Eder, Mathew P. White, Lei Zhang, Alexander J. Smalley, Simone Kühn, Claus Lamm

ID 301 - Dorsomedial prefrontal cortex plays a causal role for observational action learning
Pyungwon Kang, Marius Moisa, Alexander Soutschek, Björn Lindström, Christian Ruff, Philippe Tobler

ID 303 - Social brain networks in advanced Multiple Sclerosis patients: an explorative graph analytic approach
Joana Frieske, Aran García-Vidal, Koen Cuypers, Raf Meesen, Juli Alonso, Maria Jesus Arévalo, Ingrid Galán, Marta Renom, Ángela Vidal-Jordana, Cristina Auger, Xavier Montalban, Àlex Rovira, Jaume Sastre-Garriga, Deborah Pareto

ID 305 - Is watching fire uniquely relaxing? Electrophysiological evidence from a pilot study
Kata Horváth, Dezso Nemeth, Ivo Jacobs

ID 313 - Role of low-level visual features of symbolic stimuli in associative learning
Francesco Grassi, Julia Ruge, Esther Anna Semmelhack, Annekathrin Schacht

ID 315 - Modulations of attention orienting due to mutual gaze differ during brain stimulation to mPFC and rTPJ
Abdulaziz Abubshait, Kyveli Kompatsiari, Enrico Vescovo, Pasquale Cardellichio, Luciano Fadiga, Agnieszka Wykowska, Alessandro D'Ausilio

ID: 323 - Electrophysiological markers of feedback processing elicited by other's behaviour predict cortical responses to pain stimuli
Valentina Nicolardi, Matteo P. Lisi, Salvatore Maria Aglioti

ID 325 - Neural Correlates of Anhedonia during pleasant Touch
Sarah Aline Wellan, Anna Daniels, Henrik Walter

ID 329 - The role of intolerance of uncertainty in cognitive control and fear extinction
Marcelo Malbec, Marta Andreatta, Matthias J Wieser

ID 333 - Who did that? Source monitoring errors for performed and observed actions
Bence Neszmélyi, Roland Pfister

ID 341 - Your hand or mine? Self-other overlap in interpersonal synchrony
Elisa Gabrielle Wiedemann, Günther Knoblich, Natalie Sebanz

ID 345 - Sensitivity to basic emotional expressions and emotion perception space in the absence of facial mimicry: The case of individuals with congenital facial palsy
Arianna Schiano Lomoriello, Giulio Caperna, Elisa De Stefani, Filippo Gambarota, Pier Francesco Ferrari, Paola Sessa

ID 347 - The integration of information regarding personality traits with facial expression during emotion inference
Leora Sevi, Caroline Catmur, Geoff Bird

ID 351 - Does this house have a face? Exploring the relationship between anthropomorphism and judgements of architectural facades
Nour Tawil, Carlos R. Cassanello, Kira Pohlmann, Kirsten Kaya Roessler, Sandra Weber, Simone Kühn

ID 355 - Referencing past physically painful experiences in empathy for others' insensitivity to physical pain
Federica Meconi

ID: 361 - Maternal interoception is associated with greater engagement in mother-infant stroking and rocking
Rosie Drysdale, Manos Tsakiris

Time: Wednesday, 20/07/2022: 16:00 – 17:00
Location: Lernzone (TC.2.07-11-13-15)

ID 148 - Cross-modality effects in affective prediction construction: the role of past visual experience in subjective reactions to new affective pictures and sounds
Fiorella Del Popolo Cristaldi, Filippo Gambarota, Suzanne Oosterwijk

ID156 - Neural underpinnings of context learning in posttraumatic stress disorder: A systematic review and coordinate-based meta-analysis of fMRI studies
Sebastian Siehl, Benjamin Suarez-Jimenez, Anton Albajes-Eizagirre, Oscar Weische, Herta Flor, Frauke Nees

ID176 - Mindfulness is associated with alcohol consumption and increased reward processing in ventral and dorsal striatum during anticipation and feedback
Stella Guldner, Maren Prignitz, Frauke Nees

ID 180 - Gentle as a mother's touch: C-tactile touch promotes autonomic regulation in preterm infants
Isabella Püschel, Jörg Reichert, Jörg Bergander, Yvonne Friedrich, Kerstin Weidner, Ilona Croy

ID 184 - Grid-like codes in the human entorhinal cortex map visual space during memory formation
Luise P. Graichen, Magdalena S. Linder, Lars Keuter, Claus Lamm, Isabella C. Wagner

ID 188 - Prosociality predicts sustainable decision making better than future-orientation
Zarah Le Houcq Corbi, Alexander Soutschek

ID 190 - The frequency-dependent stimulation effects of rTMS on the performance of problem-solving tasks and ongoing oscillations
Eri Miyauchi, Masahiro Kawasaki

ID 194 - Language comprehension is modulated by the subliminal perception of facial identity
Miguel Rubianes, Laura Jiménez-Ortega, Linda Drijvers, Francisco Muñoz, Tatiana Almeida-Rivera, José Sánchez-García, Sabela Fondevila, Pilar Casado, Manuel Martín-Loeches

ID 196 - How communicative signals during joint attention promote mutual neural processes of infants and caregivers
Anna Bánki, Moritz Köster, Radoslaw Martin Cichy, Stefanie Hoehl

ID 200 - Early impact of task instructions on gaze processing: an EEG study
Nicolas Burra, Domile Tauvydaite

ID 202 - Being watched by a humanoid robot and a human: effects on affect-related psychophysiological responses
Helena Kiilavuori, Mikko Peltola, Veikko Sariola, Jari Hietanen

ID 204 - Whole brain Bayesian analysis of neural self-other-touch distinction
Adam Enmalm, Reinoud Kaldewaij, Rebecca Boehme

ID 212 - Negative scenes capture attention more strongly than neutral and positive scenes, and task difficulty does not modulate the emotional effect on the attentional capture: An ERP study
Motoyuki Sanada, Jun'ichi Katayama

ID 214 - Social task management: Switching between humanized and dehumanized perception - an exploratory EEG study
Rebecca Geiselmann, Sarah K. Crockford, Melissa J'Hurry, Anna Remington, Lasana T. Harris

ID 216 - Exploring the relationship between the perception of affective touch and endocannabinoid function in trauma and non-trauma-exposed humans
Madeleine Jones, Hilda Engelbrektsson, Connor Haggarty, India Morrison, Markus Heilig, Leah Mayo

ID 218 - Exploring the backbone of the self: A feasibility study of differential spinal cord activity during self-other-object touch
Reinoud Kaldewaij, Adam Enmalm, Robin Kämpe, Paula Salamone, Jürgen Finsterbusch, Alexandra Tinnermann, Håkan Olausson, Rebecca Boehme

ID 220 - Identifying transdiagnostic socio-cognitive profiles across 4 clinical populations
Alix Bigot, Philippe De Timary, Camille Amadieu, Sophie Leclercq, Thierry Pham, Xavier Saloppé, Luca Tiberi, Jean-Louis Nandrino, Jean-Charles Peeters, Henryk Bukowski

ID 232 - Brain Activation during affective Touch changes with the "Hunger Hormone" Ghrelin
Daniela M. Pfabigan, Uta Sailer

ID 236 - Brain mechanisms underlying metacognition in decision making
Georgia Eleni Kapetaniou, Alexander Soutschek

ID 240 - The neural underpinnings of inclusion motivation in individuals with high and low loneliness
Alisa Kanterman, Michael Nevat, Nira Saporta, Jana Lieberz, Dirk Scheele, Rene Hurlemann, Simone Shamay-Tsoory

ID 244 - Behavioral and neural dissociation of social anxiety and loneliness
Jana Lieberz, Simone G. Shamay-Tsoory, Nira Saporta, Alisa Kanterman, Jessica Gorni, Timo Esser, Ekaterina Kuskova, Johannes Schultz, René Hurlemann, Dirk Scheele

ID 248 - The neurocomputational basis of self-benefitting vs pro-environmental behavior
Boryana Todorova, Kimberly C. Doell, Lei Zhang, Paul Forbes, Sabine Pahl, Claus Lamm

ID 252 - Does a brief induction of loneliness impact neural markers of social information processing and associated parasympathetic response?
Marcelina Wiśniewska, Aleksandra Piejka, Łukasz Okruszek

ID 264 - The self and a close-other: P3 evidence for differences between processing of faces and newly acquired information
Anna Żochowska, Paweł Jakuszyk, Maria Nowicka, Anna Nowicka

ID 266 - Neurobehavioral mechanisms of psychopathological comorbidity: an RDoC multimethod assessment
Rita Pasion, Inês Macedo, Tiago O. Paiva, Christopher J. Patrick, Fernando Barbosa

ID 272 - Is recognizing communicative interactions from biological motion related to autism spectrum disorders?
Małgorzata Krawczyk, Karolina Golec, Joanna Wysocka, Łukasz Okruszek

ID 274 - Sex-related differences in recognizing negative emotions
Yasaman Rafiee, Annekathrin Schacht

ID 276 - Amplitude modulation of the Contingent Negative Variation in Psychopathy: A meta-analysis
Catarina Prata, Rita Almeida, Fernando Barbosa, Pedro R. Almeida, Fernando Ferreira-Santos

ID 282 - A meta-analysis of longitudinal total brain volume reports in autism
Sarah A Ashley, Kate Merritt, Pilar AA Letrondo, Pedro L Laguna, Avi Reichenberg, Anthony S David

ID 284 - N170 and the Black Sheep Effect
Helena Garcez, Tiago O. Paiva, Pedro R. Almeida, Fernando Barbosa, Isabel R. Pinto, José Marques

ID 286 - Effects of acute stress on entorhinal grid-like codes during virtual spatial navigation
Thomas Karner, Luise P. Graichen, Lars Keuter, Claus Lamm, Isabella C. Wagner

ID 290 - Pharmacologically increased cortisol levels impair recall of associative memory in men, but not women
Despina Antypa, Daniela Barros Rodrigues, Marie Billecocq, Ulrike Rimmele

ID 292 - Predictive processing modulations in a social perception behavioral task
Jordi Galiano-Landeira, Metodi Draganov, Deniz Doruk Camsari, Marta Robles, Lorena Chanes

ID 296 - Dissociating psychopathic traits in facial mimicry: electromyographic responses to facial expressions of emotion
Tiago O. Paiva, Rita Pasion, Carina Fernandes, Fernando Ferreira-Santos, Fernando Barbosa

ID 302 - Interactions of motivational and affective processes in time estimation
Sofia Kontaxi, Christina J. Mueller, Birgit Stürmer, Lars Kuchinke, Christine Stelzel

ID 308 - Brain and spinal cord interactions underlying conditioned pain modulation
Karita E. Ojala, Christian Büchel

ID 310 - Spatial contextual cueing in younger and older adults: An ERP study
Petia Kojouharova, Boglárka Nagy, István Czigler, Zsófia Anna GaálID 318 - Emotion regulation choice and flexibility in daily life
Anna Fischer, Alexander Ecker, Annekathrin Schacht

ID 322 - Distinct neural correlates of signal and noise in the perception of facial emotion expressions
Despina Antypa, Konstantinos Kafetsios, Panagiotis Simos, Emmanouela Kosteletou, Marina Kyvelea, Thomas Maris, Efrosini Papadaki, Ursula Hess

ID 324 - Dance expertise and emotional sensitivity
Anna Izountouemoi, Francisco Esteves

ID 330 - Syncing brains: real-time fNIRS-neurofeedback of inter-brain synchrony
Kathrin Kostorz, Trinh Nguyen, Yafeng Pan, David Steyrl, Filip Melinscak, Yi Hu, Bettina Sorger, Stefanie Hoehl, Frank Scharnowski

ID 332 - Task corepresentation in survival processing effect
Dilan Çabuk, Çağlar Akçay, Terry Eskenazi

ID 334 - Differential activation of behavioral immune system and norm violation reactions by covid-19 and flu
Hande Özlem Atar, Çağlar Akçay, Terry Eskenazi

ID 338 - Cannabis and the adolescent brain: a longitudinal assessment of mental health, cognition, and reward/feedback processing
Inês Macedo, Tiago Paiva, Rita Pasion, Laura Daedelow, Andreas Heinz, Ana Magalhães, Fernando Barbosa

ID 344 - Modes of interpersonal synchrony: is there a preference for in-phase or anti-phase coordination?
Vanda Derzsi, Thomas Wolf, Arianna Curioni, Ágnes Melinda Kovács, Natalie Sebanz

ID 348 - A covarying grey and white matter circuit separates high from low accepters. A data fusion machine learning approach
Parisa Ahmadi Ghomroudi, Bianca Monaches, Irene Messina, Alessandro Grecucci

ID 350 - CT touch induces a decrease in heart rate without any social context
Sakina Ubukata, Ikuma Adachi, Tomoko Isomura

ID 201 - How does art knowledge training impact judgments of artworks?
Ionela Bara, Emily S. Cross, Richard Ramsey

ID 356 - Associating affective voices to neutral faces – An online and ERP study
Annika Carina Ziereis, Annekathrin Schacht

ID 358 - The role of the opioid system in social cognition
Julia Braunstein, Rütgen Markus, Willeit Matthäus, Lamm Claus

ID 362 - Can people with SCA36 'Read the Mind in the Eyes'?
Rocío Martinez-Regueiro, Montse Fernández-Prieto, María-Jesús Sobrido, and Manuel Arias

ID 363 - A narrative sequencing and mentalizing training for adults with autism?
Tom Bylemans, Elien Heleven, Kris Baetens, Natacha Deroost, Chris Baeken, and Frank Van Overwalle

09:00	Keynote Lecture II: Morten Kringelbach *TC.0.10 Audimax*				
10:00	SYMPOSIUM Novel iInsights into the effects of social isolation and loneliness: Evidence from laboratory and field experiments *TC.5.01 Hörsaal* Chair(s): Giorgia Silani, Ana Stijovic	SYMPOSIUM Comparative insights into the development and evolution of the social brain *TC.5.03 Hörsaal* Chair(s): Magdalena Boch, Claus Lamm	SYMPOSIUM Current advance in healthy and abnormal gaze processing *TC.5.05 Hörsaal* Chair(s): Nicolas Burra	SYMPOSIUM Psychological processes in naturalistic social interactions *TC.5.13 Hörsaal* Chair(s): Milica Nikolic	SYMPOSIUM Bio-/Neurofeedback in mental health: Recent advances and new challenges *TC.5.15 Hörsaal* Chair(s): Florian Krause
11:30	Coffee Break - ESSAN Social Event *TC.5.01 Hörsaal*				
12:45	ESCAN Young Investigator Award Cerimony Camilla Nord & Emiel Cracco Lei Zhang *TC.0.10 Audimax*				
14:15	ORAL PRESENTATIONS Peripersonal space *TC.5.01 Hörsaal*	ORAL PRESENTATIONS Personality *TC.5.03 Hörsaal*	ORAL PRESENTATIONS Psychopharmacology *TC.5.05 Hörsaal*	ORAL PRESENTATIONS Intergroup processes *TC.5.13 Hörsaal*	ORAL PRESENTATIONS Psychopathology I *TC.5.15 Hörsaal*
15:45	Coffee Break				
16:15	SYMPOSIUM Stroke, stress, and neurodegeneration: Brain-microbiome interactions across the lifespan *TC.5.01 Hörsaal* Chair(s): Isabella Wagner	SYMPOSIUM Experiencing emotions in socially and politically turbulent times *TC.5.03 Hörsaal* Chair(s): Manos Tsakiris	SYMPOSIUM Inducing neural plasticity in higher-order cognitive networks with advanced non-invasive brain stimulation *TC.5.05 Hörsaal* Chair(s): Alejandra Sel, Emilio Chiappini	SYMPOSIUM How to measure stress? Novel approaches and biomarkers to investigate stress resilience and vulnerability in humans *TC.5.13 Hörsaal* Chair(s): Claudia Massaccesi, Sara L. Kroll	SYMPOSIUM Peripersonal and personal space: Behavioral and neural mechanisms *TC.5.15 Hörsaal* Chair(s): Georgios Michalareas
17:45	ORAL PRESENTATIONS Sensory systems *TC.5.01 Hörsaal*	ORAL PRESENTATIONS Social interaction *TC.5.03 Hörsaal*	ORAL PRESENTATIONS Social touch *TC.5.05 Hörsaal*	ORAL PRESENTATIONS Interbrain processes *TC.5.13 Hörsaal*	ORAL PRESENTATIONS Self and other *TC.5.15 Hörsaal*
19:15					
20:00	Conference Social Event Wiener Badeschiff				
23:00					

THURSDAY 21/07/2022
PARALLEL SESSIONS

SYMPOSIUM
Novel Insights into the Effects of Social Isolation and Loneliness: Evidence from Laboratory and Field Experiments
Time: Thursday, 21/07/2022: 10:00 – 11:30
Room: TC.5.01 Hörsaal

Neural and hormonal Mechanisms of impaired social Interactions in chronic Loneliness
Dirk Scheele

Alone again: altered Activation in the Action Execution System during Synchronization in High Loneliness Individuals
Simone Shamay-Tsoory

Disrupted Social Homeostasis? Comparable Effects of Social Isolation and Fasting on Energy: Evidence from the Lab and Field
Ana Stijovic

Isolation and Loneliness in Adolescence
Livia Tomova

Exploring the Regulatory Function of Solitude
Thuy-vy Nguyen

SYMPOSIUM
Comparative insights into the development and evolution of the social brain
Time: Thursday, 21/07/2022: 10:00 – 11:30
Room: TC.5.03 Hörsaal

Tuned in: Neural synchrony in mother-infant interaction
Trinh Nguyen, Drew H. Abney, Benett I. Bertenthal, Stefanie Hoehl

How the emotional state of others influences decisions across species
Valeria Gazzola

Temporal lobe evolutionary specializations facilitate human social cognition
Katherine L. Bryant, Christina N. Rogers Flattery, Matthias Schurz

Comparing brain areas for social cognition in dogs and humans: A case on convergent evolution?
Magdalena Boch, Isabella C. Wagner, Sabrina Karl, Ludwig Huber, Claus Lamm

SYMPOSIUM
Current advance in healthy and abnormal gaze processing
Time: Thursday, 21/07/2022: 10:00 – 11:30
Room: TC.5.05 Hörsaal

Eye direction detection and perception as premises of a social brain: behavioral data

Marie-Noëlle Babinet, Manon Cublier, Caroline Demily, George A. Michael

Effect of perceived eye gaze on the N170 component
Domile Taudvydaite, Ines Mares, Nicolas Burra, Atsushi Senju

Direct gaze effects in normal ageing and in Alzheimer disease
Desirée Lopis

Mutual gaze, attention and cognitive control
Agnieszka Wykowska, Kyveli Kompatsiari

SYMPOSIUM
Psychological processes in naturalistic social interactions
Time: Thursday, 21/07/2022: 10:00 – 11:30
Room: TC.5.13 Hörsaal

Learning is better with others: evidence from online and face-to-face experiments
Sara De Felice, Antonia Hamilton

Mimicry of visual humans and its effect on social affiliation
Evania Fasia, Mariska Kret

The effects of facial and physiological emotional signals in face-to-face interactions on partners' cooperation
Milica Nikolic, Chris Riddell, Bram Van Bockstaele

The role of emotional expressions during social interactions in humans and great apes
Mariska Kret

SYMPOSIUM
Bio-/Neurofeedback in mental health: Recent advances and new challenges
Time: Thursday, 21/07/2022: 10:00 – 11:30
Room: TC.5.15 Hörsaal

Getting stress-related disorders under control: a unique opportunity for neurofeedback-based therapy
Florian Krause

Fmri-neurofeedback training of sustained attention
Gustavo Pamplona

Feasibility of real-time fMRI neurofeedback training for large-scale functional connectivity networks
Franziska Weiss

Training stress resilience in action using a virtual reality biofeedback game in police officers
Abele Michela

PARALLEL SESSIONS

ORAL PRESENTATIONS
Peripersonal space
Time: Thursday, 21/07/2022: 14:15 – 15:45

Room: TC.5.01 Hörsaal

Early traumatic experiences alter both spatial and temporal principles of multisensory integration
Francesca Ferroni, Virginia Ravera, Viola Caroti, Roberto Ravera, Maria Alessandra Umiltà, Vittorio Gallese, Martina Ardizzi

Observation and imitation of emotions shape personal space in virtual reality
Ivan Patané, Clement Desoche, Romeo Salemme, Gregoire Verdelet, Alessandro Farnè, Fadila Hadj-Bouziane

Tool-use extends peripersonal space boundaries in schizophrenic patients
Francesca Ferroni, Martina Ardizzi, Francesca Magnani, Francesca Ferri, Nunzio Langiulli, Matteo Tonna, Vittorio Gallese

Pull yourself together: temporal dynamics of the rubber hand illusion
Gianluca Finotti, Sara Garofalo, Dennis Proffitt

Hands of confidence: the role of gestures on spatial problem solving and confidence in answers
Dicle Capan, Eskenazi Terry, Furman Reyhan, Goksun Tilbe

ORAL PRESENTATIONS
Personality
Time: Thursday, 21/07/2022: 14:15 – 15:45
Room: TC.5.03 Hörsaal

Anxiety vs Fear: preliminary behavioral and electrophysiological dissociation data in adolescents
Marta Filipa Oliveira, Carina Fernandes, Fernando Barbosa, Fernando Ferreira-Santos

Feedback-based updating of self-feelings in adolescents and young adults with varying levels of social anxiety: a neurocomputational approach
E.D. Kortink, L. Koban, S. Topel, P.M. Westenberg, M.J.W. van der Molen

Personality and gender differences in the perception of social interactions: an ERP and source imaging study
Elisabetta Pisanu, Sandra Arbula, Raffaella Ida Rumiati

The dark side of personality an unsupervised machine learning approach
Alessandro Grecucci, Zafer Çiftçi, Richard Bakiaj, Clara Isabel Pantoja Muñoz, Richard Bakiaj

The positive dimension of schizotypy is associated with a reduced attenuation and precision of self-generated touch
Xavier Job, Evridiki Asimakidou, Konstantina Kilteni

ORAL PRESENTATIONS
Psychopharmacology
Time: Thursday, 21/07/2022: 14:15 – 15:45
Room: TC.5.05 Hörsaal

Dopamine modulates a computational signature of subjective feelings of fatigue
Tanja Mueller, Ayat Abdurahman, Stephen Walsh, Roberta Roberts, Masud Husain, Matthew Apps

Intranasal oxytocin selectively modulates the processing of emotional faces (EEG)
Eleanor Amelia Moses, Alan Pegna, Nicole Nelson, Jessica Taubert

Longevity of resting-state oscillatory power changes and connectivity in theta, alpha and beta frequency bands following administration of oxytocin
Maciej Kosilo, Marie Zelenina, Janir da Cruz, Matt Craddock, Diana Prata

On the neurobiology of sexual objectification: Oxytocin facilitates cooperative behavior
Carlotta Cogoni, Marta Patrocínio, Maciej Kosilo, Diana Prata

ORAL PRESENTATIONS
Intergroup processes
Time: Thursday, 21/07/2022: 14:15 – 15:45
Room: TC.5.13 Hörsaal

Effect of group identity on preference similarity learning
Harry Farmer

Identity motives underlie partisan misinformation sharing in far-right supporters: a neural and behavioral perspective
Clara Pretus

On the impact of the genocide on the intergroup empathy bias between former perpetrators, survivors and their offspring in Rwanda
Emilie Caspar, Guillaume Pech, Darius Gishoma, Clémentine Kanazayire

Political spillover or stealth democracy: workplace democracy and democratic legitimacy in Europe
Bilal Hassan

The impact of shared Sense of Agency on intergroup dishonesty
Giulio Piperno, Maria Serena Panasiti, Riccardo Villa, Salvatore Maria Aglioti

ORAL PRESENTATIONS
Pyschopathology I
Time: Thursday, 21/07/2022: 14:15 – 15:45
Room: TC.5.15 Hörsaal

Abnormal functional connectivity of the habenula with the default mode network characterize treatment-resistant depression
Ana Rita Barreiros, Isabella Breukelaar, Prashanth Mayur, Jagadeesh Andepalli, Sheryl Foster, Philip Boyce, Gin Malhi, Anthony W. F. Harris, Mayuresh Korgaonkar

An eye-tracking exploration of the alcohol-related attentional bias in severe alcohol use disorder: Influence of subjective craving and cognitive load
Zoé Bollen, Arthur Pabst, Nicolas Masson, Pierre Maurage

Episodic and affective memory distortions in dysphoria: Bayesian testing of diverging theories
Sascha Duken, Liza Keessen, Herbert Hoijtink, Merel Kindt, Vanessa van Ast

Functional connectivity aberrations of the default mode and salience networks outline the continuum

major depressive disorder - bipolar disorder - schizophrenia.
Anna Todeva-Radneva, Sevdalina Sevdalinova Karaivanova-Kandilarova, Rositsa Kamenova Paunova, Drozdstoy Stoyanov Stoyanov, Ronald Sladky

The CNI model of moral decision making in alcohol use disorders and its links to social cognition deficits
Mado Gautier, Pierre Maurage

PARALLEL SESSIONS

SYMPOSIUM
Stroke, stress, and neurodegeneration: brain-microbiome interactions across the lifespan
Time: Thursday, 21/07/2022: 16:15 – 17:45
Room: TC.5.01 Hörsaal

Aberrant gut-microbiota-immune-brain axis development in premature neonates with brain damage
David Berry

The bi-directional communication along the gut-brain-immune axis in stroke
Corinne Benakis

Microbial regulation of acute stress-induced alterations in the gut metabolome: Implications for gut-brain axis signalling
Sarah-Jane Leigh

Brain-microbiome interactions in Alzheimer's Disease (t.b.a.)
Edina Silajdzic

SYMPOSIUM
Experiencing emotions in socially and politically turbulent times
Time: Thursday, 21/07/2022: 16:15 – 17:45
Room: TC.5.03 Hörsaal

Body maps of climate change emotions: where in the body do we feel emotions related to climate change?
Aleksandra Herman

The impact of social cognition and interaction on societal settings: from pandemic behaviors to judicial decisions to ideologies of violence
Agustin Ibanez

Mirror neuron activity in response to politicians' emotional displays: a pre-registered eeg study
Maaike Homan

Feeling the body-politic: the political consequences of emotions through the lens of affective neuroscience
Manos Tsakiris

SYMPOSIUM

Inducing neural plasticity in higher-order cognitive networks with advanced non-invasive brain stimulation
Time: Thursday, 21/07/2022: 16:15 – 17:45
Room: TC.5.05 Hörsaal

TMS and EEG indices of motor resonance explored through advanced multimodal method and statistics
Chiara Spaccasassi

Inducing phase-resetting by single and repetitive TMS for evaluation and modulation of EEG oscillations
Masahiro Kawasaki & Eri Miyauchi

Manipulating interregional brain coupling changes motor oscillatory activity in the human brain
Alejandra Sel

Uncovering asymmetric interhemispheric connectivity between human visual motion areas: A ccPAS study
Emilio Chiappini

SYMPOSIUM
How to measure stress? Novel approaches and biomarkers to investigate stress resilience and vulnerability in humans
Time: Thursday, 21/07/2022: 16:15 – 17:45
Room: TC.5.13 Hörsaal

The Generalized Unsafety Theory of Stress: A new perspective on stress
Julian F. Thayer

Early behavioral biomarkers of the stress response based on locomotion in virtual reality
João Rodrigues, Stephan Streuber, Erik Studer, Carmen Sandi

The Stress Factor: Underlying physiological and affective stress response structures and their associations with the endocannabinoid system
Sara L. Kroll, Raegan Mazurka, Markus Heilig, Leah M. Mayo

Cortisol and Oxytocin Concentrations during Covid-19 lockdown: Associations with affectionate touch and individuals' wellbeing
Dora Hopf, Ekaterina Schneider, Corina Aguilar-Raab, Dirk Scheele, Andreas Neubauer, Uta Sailer, Rene Hurlemann, Monika Eckstein, Beate Ditzen

How nature nurtures: Amygdala activity decreases as the result of a one-hour walk in nature
Sonja Sudimac, Vera Sale, Simone Kühn

SYMPOSIUM
Peripersonal and personal space: Behavioral and neural mechanisms
Time: Thursday, 21/07/2022: 16:15 – 17:45
Room: TC.5.15 Hörsaal

Peripersonal space, functional networks from nonhuman primates to humans
Justine Cléry

The role of Peripersonal space (PPS) in mediating self-other interactions

Andrea Serino

Investigating the effects of the COVID-19 pandemic on personal space
Daphne J. Holt

The physiological correlates of the space around the body in autism
Francesca Frassinetti

The effect of Psychopathy on the perception of interpersonal distance
Georgios Michalareas

PARALLEL SESSIONS

ORAL PRESENTATIONS
Sensory processes
Time: Thursday, 21/07/2022: 17:45 – 19:15
Room: TC.5.01 Hörsaal

Development of a chemical-perceptual space of olfaction
Antonie Louise Bierling, Alexander Croy, Thomas Hummel, Ilona Croy

Cortico-kinematic coherence and the differential weighing of sensory action effects in action planning and execution
János Horváth, Márta Volosin, Fanni Kovács, Sámuel Varga

Embodied multisensory integration in the human visual system during naturalistic movie-watching
Nicholas Hedger, Tomas Knapen

Interaction effect: do the right thing
Sara Garofalo, Sara Giovagnoli, Matteo Orsoni, Francesca Starita, Mariagrazia Benassi

Investigating the canine brain
C. N. Alexandrina Guran, Magdalena Boch, Sabrina Karl, Lucrezia Lonardo, Ronald Sladky, Ludwig Huber, Claus Lamm

ORAL PRESENTATIONS
Social interaction
Time: Thursday, 21/07/2022: 17:45 – 19:15
Room: TC.5.03 Hörsaal

Copying choice induces liking: an online study of art preferences
Paula Wicher, Eva Krumhuber, Antonia Hamilton

Loneliness is associated with reduced prefrontal activity during social interactions processing
Łukasz Okruszek, Aleksandra Piejka, Marcelina Wiśniewska

Reward Sensitivity in the Archerfish
Orit Nafcha, Simone Shamay-Tsoory, Shai Gabay

The role of the medio-prefrontal cortex for belief updating in social interactions
Patricia Christian, Alexander Soutschek

When parents are socially excluded by their own and another child: A novel event-related adaptation of the fMRI Cyberball paradigm
Dorukhan Açıl, Lara M. C. Puhlmann, Lars O. White, Pascal Vrtička

ORAL PRESENTATIONS
Social touch
Time: Thursday, 21/07/2022: 17:45 – 19:15
Room: TC.5.05 Hörsaal

Getting in Touch with the Lost Self: Vicarious and Affective Touch in Depersonalisation
Anna Ciaunica, Jothysa Matthew, Ophelia Deroy, Merle Fairhurst

Self-touch and other-touch in anorexia and autism
Morgan Frost-Karlsson, Andrea Johansson Capusan, Irene Perini, Håkan Olausson, Maria Zetterqvist, Rebecca Boehme

Shared representations between touch to self and others in people with high tactile empathy
Sophie Smit, Denise Moerel, Regine Zopf, Anina N. Rich

Social touch at a distance: recognizing types of skin-to-skin touch and their emotional content through auditory signals
Malika Auvray, Alexandra de Lagarde, Catherine Pelachaud, Louise Kirsch

Soothing the emotional brain: modulation of the neural activity by tactile social support
Jakub Kraus, Andreas Frick, Robert Roman, Lenka Jurkovičová, Radek Mareček, Michal Mikl, Milan Brázdil, Mats Fredrikson

ORAL PRESENTATIONS
Interbrain processes
Time: Thursday, 21/07/2022: 17:45 – 19:15
Room: TC.5.13 Hörsaal

Emotion sharing and empathy through art: A study of artist and viewer connections in behaviour and brain using fNIRS hyperscanning
Theresa Rahel Demmer, Corinna Kühnapfel, Matthew Pelowski

Inter-brain synchrony & Social behaviour: correlation or causation?
Giacomo Novembre

Second person approach to studying cooperative social interactions
Artur Czeszumski

Spontaneous dyadic behavior predicts self-organizing interpersonal neural synchrony
Atesh Koul, Davide Ahmar, Gian Domenico Iannetti, Giacomo Novembre

Sync-in with Friends : shared affective processing of sitcom narratives assessed through multimodal synchrony
Francois Lespinasse, Julie A. Boyle, Pierre Bellec, Basile Pinsard, Pierre Rainville

ORAL PRESENTATIONS
Self and other
Time: Thursday, 21/07/2022: 17:45 – 19:15
Room: TC.5.15 Hörsaal

Age-related differences in automatic imitation inhibition: an fMRI study
Federica Riva*, Ekaterina Pronizius*, Melanie Lenger, Martin Kronbichler, Giorgia Silani**, Claus Lamm**

Becoming someone else: Effects of virtual embodiment of others on self-perception and cognitive performance
Marieke Lieve Weijs, Annika Behlen, Jonas Schlomberg, Marte Roel Lesur, Bigna Lenggenhager

Judging harmful actions strengthens neural interactions between temporo-parietal and frontal areas: a TMS-EEG study
Chiara Spaccasassi, Stella Petkovic, Kamela Cenka, Alessio Avenanti

Self-other distinction across motor, affective, and cognitive representations is neither unitary nor domain-general
Ekaterina Pronizius, Henryk Bukowski, Claus Lamm

Suppressive TMS over posterior parietal cortex modulate precision and decision-threshold in perceptual inference: a neurocomputational mechanism relevant for subclinical psychosis?
Francesco Scaramozzino, Nicholas Furl, Ryan McKay

09:00	**Keynote Lecture III: Stefanie Höhl** *TC.0.10 Audimax*
10:00	**ESCAN General Assembly** *TC.0.10 Audimax*
11:00	**Coffee Break**

11:30	SYMPOSIUM	SYMPOSIUM	ORAL PRESENTATIONS	ORAL PRESENTATIONS	ORAL PRESENTATIONS
	Learning in social and non-social contexts in Autism	Predictive processing in development: The ontogeny of predictive minds	Emotion and cognition	Psychopathology II	Social cognition
	TC.5.01 Hörsaal	*TC.5.03 Hörsaal*	*TC.5.05 Hörsaal*	*TC.5.13 Hörsaal*	*TC.5.15 Hörsaal*
	Chair(s): Morgan Beaurenaut, Julie Grèzes	Chair(s): Fernando Ferreira-Santos			

13:00	**Prizes & Closing**
13:30	*TC.0.10 Audimax*

SYMPOSIUM
Learning in social and non-social contexts in Autism
Time: Friday, 22/07/2022: 11:30 – 13:00
Room: TC.5.01 Hörsaal

Modeling flexible behavior in childhood to adulthood shows age-dependent learning mechanisms and less optimal learning in autism in each age group
Daisy Crawley, Lei Zhang, Emily Jones, Jumana Ahmad, Beth Oakley, Antonia San Jose Caceres, Tony Charman, Jan Buitelaar, Declan Murphy, Christopher Chatham, Hanneke Den Ouden, Eva Loth

Spontaneous instrumental approach-avoidance learning in social contexts in Autism
Morgan Beaurenaut, Constance Destais, Klara Kovarski, Rocco Mennella, Julie Grèzes

Aberrant uncertainty processing is linked to psychotic-like experiences, autistic traits and reflected in pupil dilation during probabilistic learning.
Lei Zhang, Isabel V. Kreis, Matthias Mittner, Leonard Syla, Claus Lamm, Gerit Pfuhl

Responsiveness to social and non-social rewards in autism and autistic traits
Magdalena Matyjek, Mareike Bayer, Isabel Dziobek

SYMPOSIUM
Predictive Processing in Development: The ontogeny of predictive minds
Time: Friday, 22/07/2022: 11:30 – 13:00
Room: TC.5.03 Hörsaal

"Je suis constuctiviste": The consilience of Predictive Processing and Developmental Science
Fernando Ferreira-Santos

The first prior: From co-embodiment to co-homeostasis in early life
Anna Ciaunica, Axel Constant, Hubert Preissl, Katerina Fotopoulou

Face and emotion predictive processing in development
Mariana R. Pereira

How infants build basic predictions about the world around them
Moritz Köster

ORAL PRESENTATIONS
Emotion and cognition
Time: Friday, 22/07/2022: 11:30 – 13:00
Room: TC.5.05 Hörsaal

Fostering positive emotions through virtual reality: the influence of users' age and video contents on emotional responses

Katarina Pavic, Dorine Vergilino-Perez, Thierry Gricourt, Laurence Chaby

Hot and cool cognitive control in toddlers born preterm
Artemis Stefani, Kayleigh Day, Michelle de Haan, Deirdre Murray, Neil Marlow, Frederique Liegeois

How has Affective Neuroscience evolved over the last decades?
Afroditi Giannakopoulou, Giada Lettieri, Giacomo Handjaras, Marco Viola, Luca Cecchetti

New directions to crack the acoustic code of emotional prosody
Pauline Larrouy-Maestri, Marc D Pell, David Poeppel

The effects of gain and loss avoidance context on feedback processing in a flanker task
Rebecca Overmeyer, Raoul Dieterich, Tanja Endrass

ORAL PRESENTATIONS
Psychopathology II
Time: Friday, 22/07/2022: 11:30 – 13:00
Room: TC.5.13 Hörsaal

Prefrontal contributions to self-awareness and emotion regulation in dyslexia and ADHD: implications for externalizing symptoms
Eleanor R Palser, Nathaniel A Morris, Christina Veziris, Sarah R Holley, Ashlin R K Roy, Abigail E Licata, Christa Watson Pereira, Maria Luisa Mandelli, Ronald E Dahl, Maria Luisa Gorno Tempini, Virginia E Sturm

That did not age well: amygdala-mediated trust learning is impaired in older adults
Federica Riva, Ronald Sladky, Claus Lamm

Simultaneous fMRI and pupillometry reveals affective processing in a cognitive task
Julia Fietz, Dorothee Pöhlchen, BeCOME Working Group, Tanja M. Brückl, Anna-Katharine Brem, Frank Padberg, Michael Czisch, Philipp G. Sämann, Victor I. Spoormaker

Strongly held agoraphobic cognitions predict panic diagnosis and reveal a key interoceptive dimension in mental health issues. A machine learning study
Adrián Yoris, Alvaro Deleglise

Effect of DPP-4 inhibitor on social interaction and hippocampal synaptic plasticity in acute kidney injury: crosstalk through inflammation and energetics alternations
Shaimaa Nasr Amin, Dalia Azmy Elberry, Walaa Bayoumie El Gazzar, Sherif Ahmed Shaltout, Mohamed Fathi Elrefai, Hader Ibrahim Sakr

ORAL PRESENTATIONS
Social cognition
Time: Friday, 22/07/2022: 11:30 – 13:00
Room: TC.5.15 Hörsaal

Dynamic causal modeling of cerebello-cerebral connectivity when sequencing trait-implying actions
Min Pu

Effective cerebello-cerebral connectivity during implicit and explicit social belief sequence learning using dynamic causal modelling
Qianying Ma

Investigating the Role of Theory of Mind on the Moment-To-Moment Processing of Dramatic Irony Scenes in Film
Cynthia Cabañas, Atsushi Senju, Tim J Smith

Motherhood and social cognition based on child and adult faces
Irene Sophia Plank, Catherine Hindi Attar, Isabel Dziobek, Felix Bermpohl

Structural and functional alterations patterns in the cerebellum underlies social cognition deficits in the Behavioral Variant of Frontotemporal Dementia: evidence from a behavioural and MRI study
Giusy Olivito, Davide Quaranta, Libera Siciliano, Naike Caraglia, Alessia Caprara, Camillo Marra, Maria Leggio, Maria Caterina Silveri

ABSTRACTS

SYMPOSIA AND ORAL PRESENTATIONS

Wednesday 20.07.2022
Symposia Slot I: 10:00 to 11:30 h

ID: 124
Room: TC.5.01 Hörsaal

My inner feelings **vs. yours: the role of interoception on the "me-not me" distinction**

Chair(s): Louise P Kirsch (Integrative Neuroscience and Cognition Center (INCC), Université de Paris, Paris, France), Mariana von Mohr (Department of Psychology, Royal Holloway University of London, UK)

Social cognitive neuroscience has extensively studied how our own affects, thoughts and intentions may influence how we read other minds. However, the role of interoception in these processes has been greatly neglected. Despite the blooming of research on interoception, our understanding of how the perception of our physiological state influences the way we perceive our own and other's mental states remains in its infancy. To fill this gap, this symposium will bring together leading researchers in the field to address, across different domains, the role of interoception when judging self and others and how it can bias our point of view. First, Louise Kirsch will discuss the role of interoception in different levels of perspective-taking, with a particular emphasis on the links between spatial perspective-taking and interoception. Following, Francesca Ferri will present the impact of cardiac interoception on the bodily self, as well as the potential role of respiration in fine-tuning brain-heart interactions, and how this relates to interoception. Next, Katerina Fotopoulou will present a neuropsychological and developmental perspective on the interoceptive side of self-other distinction. Finally, Mariana von Mohr will show how interoception may contribute to an egocentric bias, leading to less suggestibility to be influenced by other's emotional experience and judgements when making a decision. In the end, an integrative discussion between the presenters and the audience will take place. The purpose of this symposium is not only to present innovative research on the interplay between interoception and the "me-not me" distinction, but also to highlight new perspectives.

Presentations of the Symposium

Interactions between interoception and perspective-taking: Current state of research and future directions

Louise P Kirsch[1], Chiara Baiano[2], Xavier Job[3], Malika Auvray[4]
[1]Integrative Neuroscience and Cognition Center (INCC), Université de Paris, Paris, France, [2]Department of Psychology, University of Campania "Luigi Vanvitelli", Caserta, Italy, [3]Department of Neuroscience, Karolinska Institutet, Stockholm, Sweden, [4]Institut des Systèmes Intelligents et de Robotique, Sorbonne Université, Paris, France

To perceive the world, humans tend to use an egocentric viewpoint originating from their body, the point of intersection of all sensory inputs, including interoceptive ones. However, once in interaction with another person, it is necessary to temporarily adopt their point of view. This ability requires some flexibility. Although interoception and perspective-taking flexibility have been the subject of many studies, very few have investigated their interactions. In this talk, I will first present an overview of studies to date looking at these interactions, highlighting caveats and future directions. I will then present a recent study investigating the links between spatial perspective-taking and interoception. Using a new version of the tactile Graphesthesia task in 106 participants, we were able to assess spatial perspective-taking flexibility and interoceptive abilities (from accuracy to awareness), and show how switching between different spatial perspectives is affected by the degree of focusing on one's internal body states.

Breathe in breathe out: respiratory phases specifically affect the neural monitoring of internal signals.

Francesca Ferri[1], Andrea Zaccaro[1], Marcello Costantini[2], Mauro Gianni Perrucci[1]
[1]Department of Neuroscience, Imaging and Clinical Sciences, D'Annunzio University of Chieti–Pescara, Via dei Vestini, 33, 66100, Chieti, Italy, [2]Department of Psychological Sciences, Health and Territory, D'Annunzio University of Chieti–Pescara, Via dei Vestini, 32, 66100, Chieti, Italy

The self has been largely proposed to be grounded in the monitoring of internal bodily signals. Research has shown that, for example, the subjective experiences of the space of the self and self-other distinction are associated to cardiac interoceptive accuracy and neural processing of cardiac signals. The impact of internal bodily signals on the self has mostly focused on cardiac processes. A primary role has been assigned to the brain activity locked to heartbeats, which changes when an individual is focused on oneself or internal signals, compared to external inputs. However, despite cardiac and respiratory systems are intimately linked, the potential role of respiration in fine-tuning brain-heart interactions, and how this relates to interoception and the self has been scantly investigated so far. We performed a series of studies to fill this gap in the literature showing respiratory phase-related modulations of brain-heart interactions, with effects at neural and behavioral levels.

The interoceptive side of the self-other distinction: neuropsychological and developmental studies

Aikaterini Fotopoulou
University College London

How do humans come to learn the self-other distinction? In some theories, we are born with the ability to tell self from others based on the invariant topographical structure of the body, as for example the unique visuospatial perspective afforded by the position of our eyes on the head, or the unique interoceptive information afforded by visceral receptors. This talk will examine the hypothesis that the self-other distinction is based primarily on social physiological regulation rather than merely on spatial perspective taking. Specifically, we will present a series of studies on perspective-taking, interoception and the self-other distinction and their neural correlates in patients with right-hemisphere damage (total N=78), eating disorders (N=61) and in parent-child dyads (N=64), showing deficits, or failures of perspective taking, and egocentricity and altercentricity are associated with prefrontal and temporoparietal junction activity, while interoceptive regulation is mediated by insular and limbic activity.

Interacting hearts: the role of interoception on emotional egocentric bias and social influence

Mariana von Mohr[1], Gianluca Finotti[2], Valerio Villani[1], Bahador Bahrami[3], Manos Tsakiris[1]
[1]Department of Psychology, Royal Holloway University of London, UK, [2]Department of Psychology, University of Bologna, Italy, [3]Department of Psychology, Ludwig Maximilian University, Munich, Germany

Interoception has been recently proposed to play a key role in social cognition, enabling us to navigate the different degrees of social relatedness by allowing us to correctly attribute emotional states to the self or to others. However, most research on interoception has focused on emotion and empathy, neglecting its role in social processes that require high levels of self-other distinction. To fill this gap, we conducted a series of dyad-based studies to examine how cardiac interoceptive impact, coupled with trait-like levels of interoceptive accuracy, shapes both emotional egocentric bias and social influence. Overall, we show that interoception contributes to an egocentric bias, leading to less suggestibility to be influenced by others' emotional experience and judgements when making a decision.

ID: 113
Room: TC.5.03 Hörsaal

Symposium
Keywords: joint action, mutual adaptation, interpersonal coordination

Mutual adaptation in collaborative tasks: an integrative approach to understand human-human interactions.

Chair(s): Francesca Ciardo (Italian Institute of Technology, Italy), Lucia, Maria Sacheli (University of Milano-Bicocca)
Discussant(s): Peter E. Keller (Aarhus University, Aarhus, Denmark; MARCS Institute, WSU, Sydney, Australia), Manuel Varlet (The MARCS Institute for Brain, Behaviour and Development, Western Sydney University, Australia), Francesca Ciardo (Italian Institute of Technology, Italy), Arianna Curioni (Department of Cognitive Science, Central European University Vienna, Austria), Lucia, Maria Lucia, Maria (Department of Psychology, University of Milano-Bicocca, Milan, Italy)

Underlying human interactions is the ability to extend the temporal horizon of our action planning and to act in anticipation of others' actions rather than simply responding to them. This is possible thanks to a plethora of cognitive mechanisms that support mutual adaptations during collaborative tasks. These mechanisms include the ability to represent the others' task and concurrently monitor one's own and the partner's actions as the interaction unfolds while yet keeping representations related to the self and the other separate to avoid role confusion. Implementing these processes may be costly, yet, humans seem to show a strong preference toward acting jointly instead of alone. The symposium discusses how these different mechanisms underlying mutual interpersonal adaptation may be differently involved in different types of interactions. This will be done by adopting an integrative view that combines different methodologies and approaches, ranging from dual-EEG, fMRI, and computational modeling, to developmental psychology and robotics. The symposium aims to highlight how multiple approaches are necessary to understand the human ability to perform collaborative tasks.

Each talk will last 15 minutes plus a final discussion of ca. 5 minutes

Presentations of the Symposium

Individual differences in temporal adaptation and anticipation during real-time interpersonal coordination

Peter E. Keller
Aarhus University, Aarhus, Denmark; MARCS Institute, WSU, Sydney, Australia

Precise yet flexible interpersonal coordination in domains such as group music making requires individuals to anticipate and adapt to each other's action timing. While these processes are fundamental to human interaction, they are nevertheless characterized by large individual differences. I will first describe a computational model that can be used to quantify individual differences in temporal adaptation and anticipation, as well as the focus of attention on 'self' versus 'other'. Then I will report the results of a study that applied the model, combined with personality assessment (including empathy), to data from joint drumming tasks requiring paired participants to

synchronize with one another under conditions of varying difficulty and leadership. Findings delineate links between basic sensory-motor mechanisms for fluent real-time coordination and social-cognitive processes that regulate the balance between psychological representations of 'self' and 'other'.

Self-other neural processes underlying interpersonal synchronisation through sound

Manuel Varlet[1], Sylvie Nozaradan[2], Peter E. Keller[3]
[1]The MARCS Institute for Brain, Behaviour and Development, Western Sydney University, Australia, [2]Institute of Neuroscience (IONS), Université catholique de Louvain (UCL), Belgium; [3]Aarhus University, Aarhus, Denmark; MARCS Institute, WSU, Sydney, Australia

Interpersonal coordination through sound requires individuals to continuously anticipate and adapt to the auditory effects of each other's ongoing actions. The human brain is thus faced with the computational problem of simultaneously processing information related to the actions of self and other, and, moreover, concurrently integrating these sources of information while maintaining a distinction between them. Here we use dual-EEG frequency tagging to investigate self-other processes enabling humans to achieve precise and flexible interpersonal synchronisation through sound in improvised scenarios. The results show that synchronisation between the continuous sounds of paired participants is facilitated when leadership roles are designated and when the sounds have distinct fundamental frequencies. These conditions facilitate self-other distinction, as reflected by enhanced neural tracking of self- and other-generated sounds in EEG recordings. Overall, findings highlight the critical role of self-other distinction for achieving high-level synchronisation performance in auditory interactive domains such as music ensembles

Joint actions with humanoid robots

Francesca Ciardo, Davide De Tommaso, Agnieszka Wykowska
Italian Institute of Technology, Italy

Previous studies that investigated the relationship between shared representations and response coordination suggested that coupling between co-agents underlies the possibility to represent a task as shared. In the present work, we tested the relationship between the mechanisms of coordination and shared representation by implementing a robot-mediated joint action task. We asked pairs of participants to perform a joint Simon task in which each member of the pair was seated next to the humanoid robot iCub which acted as the co-agent. The iCub robots could either perform the task in a pre-programmed manner with behaviour resembling human variability range, but with a uniform and predictable distribution or by being teleoperated by the human co-agent. Results showed that while response coordination was higher when the iCub performed in a pre-programmed and predictable way, the JSE was comparable across conditions. Taken together, our results suggest a dissociation between shared representation and response coordination.

Crazy for you! Cognitive processes supporting the decisions for joint action

Arianna Curioni
Department of Cognitive Science, Central European University Vienna, Austria

Humans are the most motivated cooperative agents among any other species. We engage in cooperative activities that allow to reach goals that are unavailable to individuals, but we often engage in cooperation independently of instrumental advantage. Here we explore the cognitive processes underlying cooperative decisions. We investigate whether adults represent the costs and benefits of joint actions when deciding to solve a task together or alone. Then we investigate infants' expectations about agents' preferences for joint over individual actions based on the instrumental utility of the action alternatives. Understanding the cognitive and motivational underpinnings of humans' preference for joint action and their developmental trajectory supports predictions of adults' behaviour in social interactions and provides insights for the design of artificial agents that can successfully interact with humans.

How shared goals shape action monitoring

Lucia Maria Sacheli, Margherita Adelaide Musco, Eraldo Paulesu
Department of Psychology, University of Milano-Bicocca, Milan, Italy

Cooperation triggers expectations on the contribution that our partners will provide. A partner, however, may sometimes violate such expectations, driving us to perform immediate adjustments. What neurophysiological mechanisms support these adaptations? I will describe behavioral and fMRI evidence for an interaction-specific fronto-opercular brain system that can decode a partner's error and promote adaptive responses during collaborative interactions. During fMRI, the participants played short melodies with a virtual partner by performing one note each in turn-taking. A colored cue indicated which melody they had to execute at each trial, thus generating expectations on what notes the partner would play. The participants also performed the task in a perceptually-matched Non-Interactive context. The behavioral and neurofunctional adaptations showed by the participants when the partner violated their expectations provide evidence for the human tendency to anticipate a partner's performance and amend his/her mistakes during motor interactions, but only when guided by a shared goal.

ID: 103
Room: TC.5.05 Hörsaal

New directions on the Social and Emotional Cerebellum

Chair(s): Frank Van Overwalle (Vrije Universiteit Brussel, Belgium)

This symposium explores new directions on the role of the cerebellum in the social understanding of and emotions of others.

We kick off with a novel task-based parcellation of the cerebellum by Frank Van Overwalle which originated from empirically-based ontological terms associated with task-based studies in NeuroSynth. This functional parcellation demonstrates an important role of mentalizing, or reading the mind and emotions of other people, besides other major functional networks that have been discovered in the neocortex.

Ciricugno also explored the functional topography of the cerebellum during the comprehension of others' emotional states using TMS. She found a cerebellar medial-to-lateral gradient in response to affective functions, with medial regions dedicated to emotional features of facial expressions and lateral regions involved in their recognition.

Popal investigated whether the posterior cerebellum is involved in understanding the nuances of social relationships, and found that portions of the posterior cerebellar Crus were specifically sensitive to the "formality" dimension of social relationships (e.g., boss-employee relationships).

Siciliano compared the social role of the posterior cerebellum for inferring emotions and beliefs among individuals with cerebellar disease, autism spectrum disorders and bipolar disorders. She found overlap as well as differences among the three groups, with reduced grey matter in the right Crus II shared by all groups.

Finally, Haihambo wondered to what extent social thinking supports predicting social actions in the future. She found that the posterior cerebellum supports the prediction of the type and temporal order of social actions based on personality traits.

Presentations of the Symposium

A functional atlas of the cerebellum based on neurosynth task-coordinates

Frank Van Overwalle, Qianying Ma, Naem Haihambo, Tom Bylemans, Beatriz Puerta Catoira, Mahyar Firouzi, Meijia Li, Min Pu
Vrije Universiteit Brussel and Center for Neuroscience, Brussels, Belgium

Although the human cerebellum has a surface that is about 80% of that of the cerebral cortex and has about four times as much neurons, its functional organization is still very much uncharted. Despite recent attempts to provide resting-state and task-based parcellations of the cerebellum, these two approaches lead to large discrepancies. We developed a comprehensive task-based functional parcellation of the human cerebellum based on a large-scale functional database, NeuroSynth, involving an unprecedented diversity of tasks which were reliably associated with functional key descriptors. Involving over 44500 participants, we present a functional parcellation that exhibits replicability with earlier resting-state parcellations across cerebellar and neocortical structures, confirming the major networks revealed in prior work, including the *mentalizing* network and tiny patches of a *limbic* network. These locations are roughly similar to prior resting-state cerebellar parcellations, although they are less symmetric and robust across the two hemispheres.

Functional topography of the cerebellum in response to the comprehension of others' emotional states: a TMS study

Andrea Ciricugno[1], Chiara Ferrari[1], Maria Arioli[2], Zaira Cattaneo[1]
[1]IRCCS Mondino Foundation, Pavia, Italy, [2]Department of Human and Social Sciences, University of Bergamo, Bergamo, Italy

Nowadays, it is well-established that the cerebellum is a crucial structure in mediating the understanding of others' emotions. We carried out a series of experiments with the aim to explore the functional topography of the (posterior) cerebellum based on its neural responses during the different operations involved in the comprehension of others' emotional states. In particular, we tested, employing transcranial magnetic stimulation (TMS), the contribution of paravermal and lateral cerebellar regions in the discrimination of facial emotional expressions and in the recognition of facial emotional expressions embedded in emotional contexts. Preliminary results point to the existence of a cerebellar medial-to-lateral gradient in response to affective functions, with regions dedicated to the processing of emotional features of facial expressions located medially (in vermal and paravermal areas) and those involved in recognition of others' emotions based on facial and contextual cues located in more lateral sectors of the (left) cerebellum.

The posterior cerebellum helps process concepts about social relationships

Haroon Popal[1], Katie Jobson[1], Yin Wang[2], Mark A. Thornton[3], Ingrid R. Olson[1]
[1]Department of Psychology and Neuroscience, Temple University, [2]State Key Laboratory of Cognitive Neuroscience and Learning, and IDG/McGovern Institute for Brain Research, Beijing Normal University, [3]State Key Laboratory of Cognitive Neuroscience and Learning, and IDG/McGovern Institute for Brain Research, Beijing Normal University; 3. Psychological and Brain Science, Dartmouth College

We asked whether the posterior cerebellum was involved in understanding the nuances of social relationships. Young adults received an fMRI scan while performing a task that required a decision about which scenario between two individuals was more likely, given their particular social relationship. The task did not include sequential information

and working memory load was minimal. Results showed that regions of the "social brain", such as the ventromedial prefrontal cortex, were recruited during this task. In addition, portions of crus I/II were activated. Searchlight RSA showed that crus I/II was specifically sensitive to the "formality" dimension of social relationships (e.g. knowledge about boss-employee relationships). Last, connectivity analyses show that the activated region of the posterior cerebellum was preferentially connected to the social cerebrum. It is possible that inhibitory activity in crus I/II dampens spreading activation in cerebral social knowledge networks, helping to pinpoint appropriate social meaning.

Emerging evidences on the social role of the human cerebellum: from cerebellar disease to psychiatric and neurodevelopmental disorders.

Libera Siciliano, Giusy Olivito, Maria Leggio
Department of Psychology, Sapienza University of Rome and Ataxia Laboratory, IRCCS Santa Lucia Foundation, Rome, Italy.

Up-to-date advances on cerebellar operations suggest the posterior cerebellum as a hub for the processing and prediction of complex social stimuli. Social-cognitive impairments impact everyday functioning in neurological, neurodevelopmental and psychiatric conditions whose brain modifications involve the cerebellum. To test the hypothesis that the posterior cerebellum has a domain-specific role in social cognition, we compared the ability to infer emotions and beliefs among individuals with cerebellar disease, autism spectrum disorders and bipolar disorders. Participants were administered specific social cognition tests and underwent a brain MRI to examine cerebellar structural alterations. We found overlapping as well as differing trends among the three groups both for social cognition performances and for cerebellar grey matter reduction. The overlapping area of reduced grey matter was found in a portion of the right Crus II, explaining the mentalizing difficulties shared among the groups. These results evidenced a domain-specific role of the cerebellum in social cognition.

Social thinking is for doing: The posterior cerebellum supports prediction of social actions based on personality traits

Naem Haihambo[1], Qianying Ma[1], Frank Van Overwalle[2]
[1]Vrije Universiteit Brussel and Center for Neuroscience, Brussels, Belgium, [2]Vrije Universiteit Brussel

Can we predict the future by reading others´ minds? This study explores whether attributing others' personality traits facilitate predictions about their future actions and their temporal order. Prior evidence demonstrated that the posterior cerebellar Crus is involved in identifying the temporal sequence of social actions and the person's traits they imply. In this study, participants were informed about the trait of a person, and then had to select actions that were consistent with this information and arrange them in the most likely temporal order. As hypothesized, the posterior cerebellar Crus 1 and 2 were strongly activated when compared to a control task which involved only the selection of actions (without temporal ordering) or which depicted non-social objects and their characteristics. Our findings highlight the important function of the posterior cerebellar Crus in the prediction of social action sequences in social understanding.

ID: 115
Room: TC.5.13 Hörsaal

Symposium
Keywords: Environmental Neuroscience, Sustainability, Neuroimaging techniques

The utility of neuroscience in sustainability and climate change research: The emerging field of Environmental Neuroscience

Chair(s): Kimberly C. Doell (University of Geneva, Switzerland)

When it comes to understanding the reciprocal relationships between the environment and the human brain, neuroscience is only beginning to demonstrate how useful its contribution can be. From this perspective, the emerging field of environmental neuroscience can provide unique insights into the cognitive mechanisms underlying psychological and behavioral phenomena (e.g., sustainable behaviors), and how our changing environments can impact different aspects of brain health and well-being. There is no doubt that the climate crisis is worsening; environmental neuroscience may give us some unique insights into how to mitigate it, and what the neural consequences might be.

This symposium aims to showcase a variety of neuroimaging techniques that can be utilized to understand these important issues. Kimberly Doell will demonstrate how specific functional reward-related neural correlates can predict the frequency of real-world sustainable and unsustainable behavior. Damien Brevers will demonstrate the neural mechanisms underlying prospective thinking about both broad and very specific sustainable and unsustainable behaviors. Emmanuel Guizar will demonstrate how cortical thickness can be used as a stable "neural trait", differentiating participants who act sustainably (or not) towards future generations. Simone Grassini will demonstrate how EEG can be used to understand the impact of nature exposure on regulating the brain's response to emotional stimuli. Finally, Simone Kühn will present a series of work that exemplifies the major impact that external environments have on brain plasticity and behavior. Together, this work highlights different pathways by which neuroscience can powerfully contribute to research in this domain.

Presentations of the Symposium

The neural correlates of daily sustainable and unsustainable behavior

Kimberly C. Doell[1], Tobias Brosch[2]
[1]University of Geneva & New York University, [2]University of Geneva

The goal of this presentation is to outline the importance of environmental neuroscience. Recent work in this domain will be reviewed, and a framework that links together the talks in this symposium will be sketched out. Next, recent results of a large-scale, multimethod project will be presented, which aimed to demonstrate the utility of combining functional neuroimaging with traditional environmental psychology techniques to predict daily sustainable and unsustainable behavior (measured via experience sampling). Here, activity extracted from completely different brain regions predicted sustainable and unsustainable behavior (the amygdala/prefrontal cortex, and the striatum, respectively), suggesting that there may be distinct neurocognitive mechanisms linked to each type of behavior. Additionally, brain measures predicted the frequency of both sustainable and unsustainable behavior beyond several psychological antecedents. This work demonstrates the utility of harnessing environmental neuroscience approaches, and sheds light onto the individual-level neural dispositions to act to protect/harm the environment.

From imagining to acting your pro-ecological self: insight from brain mechanisms underlying prospective thinking of pro-environmental behaviors

Damien Brevers
Université Catholique de Louvain

The goal of this presentation is to provide new insights as to how and why functional magnetic resonance imaging research can contribute to significant progress towards the understanding on how the human mind can switch from mere feasibility judgements to the actual and persistent (dis)engagement into (un)sustainable conducts. In the first part of the talk, I will present the findings of a recent study that aimed to examine the brain mechanisms underlying prospective thinking of (un)sustainable behaviors. In the second part of the talk, I will describe the results of an ongoing study that focus on when and how to be physically active in a pro-ecological society by studying the brain mechanisms underlying future-oriented mental imagery of "plogging" (i.e., running while picking-up trash). I will then conclude by addressing short-term research perspectives.

Individual differences in intergenerational sustainable behavior are associated with cortical thickness in DMPFC and DLPFC.

Emmanuel Guizar Rosales, Thomas Baumgartner, Daria Knoch
University of Bern & The Swiss Institute for Translational and Entrepreneurial Medicine

There are large individual differences in sustainable behavior, and it is not well understood why some behave sustainably towards future generations while others do not. Moreover, previous research on this topic is rare and has mainly relied on subjective self-report measures.

In this study, we measured cortical thickness as a stable and objective anatomical brain characteristic to explain individual differences in intergenerational sustainable behavior. We combined these neural task-independent data with individuals' behaviors in a behavioral economic paradigm measuring sustainable behavior towards a future generation.

We found that, compared to individuals that were acting unsustainably towards future generations, those that were acting sustainably were marked by greater cortical thickness in DMPFC (associated with perspective-taking abilities) and DLPFC (associated with self-control capacities).

By using this neural trait approach, we were able to differentiate intergenerationally sustainable and unsustainable individuals, which allows for speculation about the socio-cognitive mechanisms underlying these differences.

How nature-exposure may be important for regulating brain activity in response to emotions

Simone Grassini
University of Stavanger & NTNU - Norwegian University of Science and Technology

Multiple studies have investigated how functional brain activity is modulated by exposure to nature. Evidence shows that exposure to nature may modulate the activity in important brain regions, including the amygdala - which responds to emotional stimuli. Here, we used markers of early attentional processes measured via electroencephalography to track emotional responses to neutral and threatening faces, following a short exposure to a video. The three different types of 3-minute videos displayed were natural, urban, and "neutral" (not nature nor urban) environments. Preliminary data shows that early-attentional processes (early posterior negativity) to faces are reduced after a nature video compared to the other conditions. This early-attentional process down-modulation has often been –speculatively– connected with decreased activation in the amygdala. Our preliminary data suggests that short nature-videos may be enough to produce a short-term effect on attentional processes, possibly connected to a modulation of other brain structures, such as the amygdala.

Testing the effects of physical environments on the human brain

Simone Kühn
Max Planck Institute for Human Development & University Clinic Hamburg-Eppendorf

We assume that the external environment has a major impact on brain plasticity as well as on behavior. However, the influence of the physical environment is oftentimes neglected, in particular in the human neurosciences. In order to fill this gap, the discipline of Environmental Neuroscience has evolved, that may help to clarify the mechanisms behind restorative effects of nature and therewith provide answers to the question whether the effects are accomplished via a cognitive or affective route (Attention Restoration Theory vs. Stress Recovery Theory). Within the

scope of this presentation, research will be presented that attempts to link features of the living environment to brain structure and function. Moreover, several studies will be presented demonstrating that short- or long-term interactions with natural environments (such as a walk in a forest, watching pictures of nature or exposure to virtual nature environments) may improve cognition, brain activity as well as mental health.

ID: 109
Room: TC.5.15 Hörsaal

Symposium
Keywords: social neuroscience, perception, computational psychology, interactions, predictive processing

Domain-general building blocks of social interactions

Chair(s): Shir Atzil (Hebrew University, Israel), Yuval Hart (Hebrew University, Israel)
Discussant(s): Christian Keysers (Netherlands Institute for Neuroscience, KNAW, Amsterdam, The Netherlands), Lorena Chanes (Universitat Autònoma de Barcelona, Spain)

Social interactions require highly complex cognitive and behavioral capacities. In this symposium we focus on how fundamental processes interact to enable the cognitive complexity needed to socially interact. We will discuss how domain-general processes, such as metabolism, motor control, neural computations and perception, interact to enable social proficiency. The first talk will discuss how social dependency in metabolic regulation is a robust driving force for social learning and brain development. The second talk will discuss the early warning signals in motion inference and the computations needed to make them predictive of others' intentions for a quick and accurate response. The third talk will discuss the neural computations of predictive processing, and how they promote social behavior. The fourth talk will discuss the contribution of the nociceptive system to social interactions, and the role of the cingulate cortex in sharing the pain of others. Altogether, the search for domain-general building blocks of social processing will deepen our understanding of the neuro-behavioral mechanisms of sociality.

Presentations of the Symposium

Social regulation of allostasis is a mechanism for bonding

Shir Atzil
Hebrew University, Israel

The brain is constantly working to maximize the metabolic efficiency of the internal milieu by learning to associate between the body's physiological requirements and the statistical regularities in the environment. This process is called allostasis. In social animals such as humans, infants are helpless in maintaining their ongoing regulatory needs, they depend on a dedicated caregiver for allostasis. Being cared for strongly motivates infants toward social learning, reinforced by allostasis regulation. In line with this, the neural circuits that are consistently involved in social processing, are in charge of allostasis. The amygdala, NAcc insula, and ACC, are visceromotor regions, which via the autonomic and endocrine systems regulate the internal milieu. These are connected to cortical regions that process perception, action and abstract representations. Through allostasis-driven learning, infants learn to socially interact. Through this lens, allostasis is a domain-general process with a mechanistic role in social learning, brain processing and behavior.

Early warning signals in motion inference

Yuval Hart
Hebrew University, Israel

At the basis of social interactions lies a cohort of subtle movements that signal invitations, affects, and intentions. What are the informational cues that propel decision-making in social contexts? In this talk, I will present an antagonistic game, where Blockers react within ~120ms from Attackers' motion onset. We borrow concepts from criticality theory to show that early warning signals exist in people's motoric decision making. The early warning signals - a sharp rise in motion's autocorrelation and in the autocorrelation decay time - occur ~130 ms before motion onset and strongly correlate with Attackers' motion onset and with Blockers' response times. We simulated the motion of the critical transition to show that people react faster to motion with early warning signals than to its uncorrelated counterpart. Together, our findings suggest people can recognize and quickly act upon motoric decision making by inferring its early warning signals.

Expectations and social experience in health and disease

Lorena Chanes
Universitat Autònoma de Barcelona, Spain

Facial expressions are an important element for social communication. From a predictive processing standpoint, we process and interpret facial expressions within our internal model of the world built based on past experiences. Not only do we constantly generate expectations about facial expressions based on that internal model, but such expectations importantly impact how we experience others. Disruptions of facial expression perception have been associated with numerous mental disorders. Predictive processing may act as a building block, i.e., be a domain-

general mechanism underlying the different disruptions observed and may offer a new framework to understand commonalities and particularities across traditionally distinct mental health entities.

The role of nociceptive brain regions in emotional contagion and danger detection

Christian Keysers
Netherlands Institute for Neuroscience, KNAW, Amsterdam, The Netherlands

For social animals, the ability to sense the distress of others is a powerful way to detect dangers. While some theories emphasize specialized brain regions that process the social world, I will focus on the role of regions traditionally associated with an individual's own nociception. I will show that rats maximize their preparedness to face danger by letting the distress or safety cues of other animals infect them. By recording from nociceptive neurons in the cingulate cortex, i.e. neurons responding to noxious stimuli, we found that some of them become reactivated while witnessing the distress of others. Deactivating the cingulate reduces this emotional contagion. That this region is the homologue of the cingulate cortex found to be activated while humans witness the distress of others, demonstrates an evolutionarily conserved 'early warning' system that triggers defensive states when the distress of others signals the presence of dangers.

Wednesday 20.07.2022
Oral Presentations Slot I: 13:00 to 14:30 h

ARTIFICIAL AGENTS
Room: TC.5.01 Hörsaal

ID: 170

Keywords: social cognition, two-person neuroscience, social interaction, human-robot interaction

Domain-specific and domain-general neural network engagement during human-robot interactions

Ann Hogenhuis, Ruud Hortensius
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To what extent do domain-general and domain-specific neural networks generalise across interactions with human and artificial agents? In this exploratory study, we analysed a publicly available fMRI dataset (n = 22; Rauchbauer, et al., 2019) to probe the similarities and dissimilarities in neural architecture while participants conversed with another person or a robot. Incorporating trial-by-trial dynamics of the interactions, listening and speaking, we used whole-brain, region-of-interest, and functional connectivity analyses to test response profiles within and across social or non-social, domain-specific and domain-general networks, i.e., the person perception, theory-of-mind, object-specific, language, multiple-demand networks. Listening to a robot compared to a human resulted in higher activation in the language network, especially in areas associated with listening comprehension, and in the person perception network. No differences in activity of the theory-of-mind network were found. Results from the functional connectivity analysis showed no difference between interactions with a human or robot in within- and between-network connectivity. Together, these results suggest that while similar regions are activated during communication regardless of the type of conversational agent, activity profiles during listening point to a dissociation at a lower-level or perceptual level, but not higher-order cognitive level.

ID: 192

Keywords: Sense of Agency, Electroencephalography, Human-Robot Interaction, Social Cognition

Joint Sense of Agency in Human-Human and Human-Robot Interaction

Uma Prashant Navare[1,2], Kyveli Kompatsiari[1], Francesca Ciardo[1], Agnieszka Wykowska[1]
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Sense of Agency (SoA) is the experience of control over one's actions and the resulting outcomes. People also experience a joint SoA (JSoA) during joint action (JA) with another human, indexed by similar implicit SoA for their own and their co-agents' actions. JSoA is not experienced when acting with a disembodied artificial agent like a computer. The present study investigated the experience of JSoA during JA with a humanoid robot. Participants performed a "target-tracking-and-detection" task alone and with a co-agent. When acting together, one agent performed the target tracking, while the other the target detection, following which the roles were reversed. Target detection triggered a tone after a variable delay. Across two experiments the co-agent was either a human confederate (Experiment 1) or the humanoid robot iCub (Experiment 2). Implicit SoA was measured by asking participants to estimate the time interval between the moment of target detection and the elicited tone.

Electroencephalography data were also collected. The interval estimate results showed that while participants appeared to form a JSoA with the human confederate (Experiment 1), participants did not form a JSoA with iCub (Experiment 2), indicating JSoA during JA differs as a function of the type of embodied co-agent. Furthermore, in Experiment 2 the auditory N100 elicited by iCub- triggered tones was more suppressed as compared to the N100 elicited by participant(self)-triggered tones, indicating comparatively reduced sensory processing of the robot-triggered tones. Together, our results shed new light on the phenomenon of JSoA for human-human and human-robot interaction.

The interplay of human-likeness and intentionality attribution for vicarious sense of agency over humanoid robot actions

Cecilia Roselli[1,2], Francesca Ciardo[1], Davide De Tommaso[1], Agnieszka Wykowska[1]
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Sense of Agency (SoA) is the feeling of authorship towards one's actions and outcomes. In a shared social context with other agents, people can experience a "vicarious" SoA towards others' actions and outcomes when the co-agent is another human; however, it remains unclear whether the same occurs in Human-Robot Interaction (HRI). The present study aims at investigating whether humanoid robots elicit vicarious SoA in humans, and whether its occurrence depends on the degree of intentionality attributed to them. Thus, adult participants were asked to perform an Intentional Binding (IB) task both alone (Solo Context) and together with the humanoid iCub robot (Social Context), and to report the time of occurrence of self- and robot-generated actions. Before the experiment, the individual tendency of attributing intentionality to robots was assessed. Results showed that participants experience implicit SoA, in form of the IB effect, over both self- and robot-generated actions. Notably, the magnitude of vicarious SoA was comparable to individual SoA, suggesting that the way people represent one's and humanoid robot's actions may share common underlying mechanisms. Furthermore, the more participants attributed intentionality to robots, the stronger vicarious SoA they experienced towards iCub's actions, suggesting that intentionality attribution plays a role in vicarious SoA over humanoid robot actions. In conclusion, our results highlight the interplay of human-likeness and intentionality attribution for the emergence of vicarious SoA in HRI.

Exploring the relationship between aesthetic appreciation and stimulus and knowledge cues to human animacy.

Kohinoor Monish Darda[1,2,3], Aaron Maiwald[4], Emily S Cross[1,2,5]
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In a world that is leading to a merging between humans and machines, challenging questions arise – do we evaluate artificial art and agents in the same way as their human counterparts? Across two pre-registered, statistically powered experiments, we investigated the relationship between stimulus and knowledge cues to human animacy on people's aesthetic preferences for dance. Using human and robot avatars, computer- and human-generated choreographies, and an elaborate belief manipulation (whether movement is believed to have human/artificial origins), our findings suggest a double dissociation such that human-generated choreographies were preferred when participants believed the movement had human origins; computer-generated choreographies were preferred when participants believed the movement had artificial origins, irrespective of the agent (human/robot avatars; Experiment 1 (N=62)). Knowledge cues to human animacy (i.e., belief that a choreography is human-generated when it is not) showed a bias toward humanness - choreographies believed to be human-generated were rated as smoother than computer-generated choreographies (Experiment 2A (N=67)). Knowledge cues to artificialness (i.e., belief that a choreography is computer-generated when it is not) showed a bias against artificial art - choreographies believed to be computer-generated were rated as less beautiful than human-generated choreographies irrespective of the agent (human/robot avatars; Experiment 2B (N=69)). Aesthetic ratings were also modulated by participants' attitudes toward artificial intelligence (AI), and their expertise with dance and technology. Along with physical form and content, viewers' beliefs and attitudes toward humanness or artificialness of artificial agents and art productions will need to be optimised for effective human-computer interactions.

Identifying with an avatar face changes mental representation of one's real face

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Cognitive processing of images of one's face is to great degree special: they attract attention and people are faster and more accurate to detect and recognize them. Moreover, recent studies found that similar effects can be observed also for images of unknown faces that have been associated with the self, i.e. for avatar faces. What remains unexplored is whether, and if yes then to what extent, identifying with an avatar face changes mental representations of one's real face. In order to investigate this issue we conducted three experiments in which we presented participants with images of morphs between their real faces, self-associated unfamiliar faces (avatar faces), and stranger-associated unfamiliar faces. The participants' task was to judge to which of these identities each presented morph was most similar. Based on these responses we calculated the points of subjective equivalence (PSE) between each face. We discovered that when participants did the task in which they identified with an avatar face (a) the PSE between their real face and an avatar-face was shifted towards the real face, and (b) the PSE between their real face and a stranger-face was shifted towards the stranger-face. These results suggest that identifying with an avatar face changes the mental representation of one's real face making it less similar to the avatar-face and more similar to the stranger-face.

AUTISTIC SPECTRUM DISORDERS
Room: TC.5.03 Hörsaal

ID: 328

Keywords: Autism, predictive processing, facial expressions, social perception

Facial expression predictions in autism

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Autism has been characterized by differences in how predictions and sensory information are processed in the brain when compared to typically-developing individuals. Recent accounts of autistic perception suggest differences in modelling representations of the world through such prediction-based inference. Adults with autism (n=34) and gender-matched typically-developing (TD) individuals (n=34) were assessed using a behavioral paradigm to assess predictive processing in the domain of facial expressions. The task is designed to elicit expectations about facial expressions that are then fulfilled to a given extent (by presenting a stereotypical expression for the evoked emotion; matched trials) or not (by presenting a stereotypical expression for a different emotion category than the one evoked; nonmatched trials). We computed a predictability rating, as well as collecting a rating of social evaluation (likability rating). We observed differences in predictability ratings for autistic v. typically-developing individuals. More specifically, autistic individuals held less stereotypical predictions about facial expressions, as gauged by smaller differences for predictability ratings for matched and nonmatched trials. Less stereotypical facial expression predictions could represent a new framework to understand widely described "emotion recognition deficits" in autism.

ID: 146

Keywords: SSBP3, autism, intellectual disability, balanced translocation, zebrafish

Single-strand DNA-binding protein SSBP3 is a main neurodevelopmental driver in 1p32.3 microdeletion/microduplication syndrome

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1p32.3 microdeletion/microduplication syndrome is a contiguous genomic disorder characterized by overlapping cardinal phenotypes of intellectual disability (ID) and craniofacial anomalies (CFA). Due to the large number of genes in this genomic region, the identity of the disease gene(s) associated with these main clinical features has remained elusive. By employing breakpoint mapping of two independent subjects with balanced translocations involving 1p32.3 and comparative mapping of 9 CNVs, including both microdeletions and microduplications as well as 6 intragenic variants in 8 individuals with matching phenotypes, we provide evidence that the ID and CFA phenotypes are both caused by disruption of a single gene, SSBP3. We have complemented the human genetic data by genetic manipulation of the zebrafish and Drosophila SSBP3 orthologs, which led to both craniofacial and behavioral phenotypes. As a member of the head organizer complex, SSBP3 is a single-strand DNA-binding protein whose murine, zebrafish, and Drosophila orthologs are expressed in a manner consistent with a function in neuronal development. Knockdown of the respective SSBP3 orthologs led in the zebrafish to disruption in neuronal cell development, causing microcephaly and stunted jaw and in Drosophila to altered wing and brain development along with defects in habituation learning and sensory perception behaviours. The effects of SSBP3 dosage could act through any of several mechanisms, including DNA repair and transcriptional regulation. Based upon the human genetic data supported by the lower organism models, we propose that aberrant dosage of SSBP3, either increased or decreased, underlies the ID, CFA and autism in this genomic disorder

ID: 242

Social attention and social reinforcement learning – a naturalistic eye tracking paradigm and computational modelling of responses to emotional point-light-**displays (PLD's)**

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Attention to socially important regions of the face is a key component of daily social interaction and precedes fundamental social skills such as emotion recognition, nonverbal communication and mentalizing. It is also an essential prerequisite to social learning, i. e. when integrating emotional feedback to one's behavior. Direct eye contact is a salient social signal and, along with the aforementioned social skills, is often found to be atypical in disorders characterized by social impairments such as autism spectrum disorder (ASD). However, studies investigating eye gaze on faces often rely on static picture stimuli, which differ remarkably from real-life social interaction. Here, we developed a novel eye tracking paradigm which uses mobile eye tracking in conjunction with AI face-recognition software, to allow fixations to eyes, mouth and face to be measured during a real-life conversation. Performance in the task was investigated in association to 1) social learning in a reinforcement learning task using point-light-displays (PLD's) of emotional faces and 2) levels of autistic traits in a neurotypical sample measured by the Autism Spectrum Quotient (AQ). Computational modelling of trial-by-trial responses was used to determine more comprehensively which parameters of learning were modulated by attention to socially relevant regions and autistic traits. With this study, we aim to provide a method to investigate social attention in a more ecologically valid context, which will pave the way for more precise and valid studies on social attention and ASD.

ID: 227

The physiological correlates of social space dysregulation in children with autism

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Interpersonal space (IPS) is the social space that individuals maintain between themselves and others and that, when it is violated, cause discomfort. The IPS's extent depends on others' behaviour, and the closeness with an unknown person increases the skin conductance response (SCR), linking between behavioral and autonomic components of IPS.

We investigate if the deficit in IPS regulation reported in children with Autism Spectrum Disorders (ASD), is associated to an altered autonomic response to social proximity.

Children with typical development (TD) and children with ASD performed two Experiments. In Experiment 1, participants stopped an unknown adult (confederate), who moved toward to or away from them, when they felt comfortable with other's distance (comfort-distancetask). In Experiment 2, participants' SCR was recorded when the confederate moved and briefly stopped at five spatial positions, simulating an approach/withdrawal movement.

We found that ASD children preferred a larger IPS and exhibited higher SCR than controls. Interestingly, in TD and ASD children, the SCR increased when the confederate was closer to them, reflecting the ability to detect a possible threat around the body. However, in TD children this effect was observed in Approaching but not in Withdrawal condition, whereas in the ASD children the SCR was not modulated by the confederate's movement direction. This result can be ascribed to a deficit in ASD children in anticipating the movement direction performed by the confederate.

We reveal that impairment of both physiological responses and predictive mechanisms contribute to abnormal IPS regulation found in autism.

ID: 316

Wanting and liking of affiliative touch and food rewards in autism spectrum disorder: A simultaneous fMRI and facial EMG study

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Autism spectrum disorder (ASD) is a complex condition characterized by social deficits. According to one influential theory, ASD may entail dysfunctional processing of social reward conducive to reduced motivation to approach and engage with social stimuli. Despite this theory, a recent metanalysis has indicated a generalized deficit in reward processing, which also pervades non-social contexts. Here, we sought to elucidate reward processing in ASD individuals by disentangling their response to social and non-social stimuli, across both 'wanting' (the motivation to obtain a reward), and 'liking' (the hedonic value associated with reward consumption) components. To this end, we tested 25 ASD and 25 neurotypical (NT) individuals using a reward paradigm which included trial-by-trial anticipation and consumption of matched primary social (affiliative touch) and non-social (real food) stimuli. Concurrently, their neural and facial muscular (i.e. corrugator supercilii muscle) activity was acquired by simultaneous functional magnetic resonance imaging (fMRI) and electromyography (EMG). Preliminary results indicate that wanting and liking ratings of the stimuli did not differ between groups. However, fMRI analyses suggest that, as compared to NTs, during reward anticipation ASD individuals showed higher generalized brain activity, including in the orbitofrontal cortex, whereas during reward consumption they showed reduced ventromedial prefrontal cortex activity. Further, EMG data showed that the expected corrugator supercilii relaxation for greater subjective ratings of liking was observed in NT but not in ASD individuals. Taken together these findings support the notion of atypical reward processing in ASD, which extends beyond the social domain.

VIRTUAL AND REAL BODY PERCEPTION
Room: TC.5.05 Hörsaal

ID: 281

Body Ownership and the Neural Processes of Memory Encoding and Reinstatement

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Memories are inextricably tied to having a body. Yet, we are just beginning to understand how the fundamental perception of one's body as one's own (i.e. body ownership) influences our ability to form and retrieve memories. We immersed participants within pre-recorded videos viewed through VR glasses, which depicted realistic events including a first-person view of a mannequin's body aligned with the location of the participants' real bodies during fMRI scanning. We manipulated feelings of body ownership over the mannequin using a perceptual full-body illusion. Participants saw an object touch the mannequin and simultaneously felt touches on the corresponding location of their real body, which created an illusory sense of ownership over the mannequin. As a control condition, we disrupted the illusion by delivering seen and felt touches in an alternating pattern. 1 week later, participants retrieved memories for the videos during fMRI scanning. Preliminary results suggest that patterns of activity during encoding in lateral frontal, medial and lateral temporal, posterior parietal, and visual cortices were able to differentiate between memories encoded with differing levels of body ownership. Further, by correlating patterns of activity at encoding and retrieval, we found that forming memories with intact compared to disrupted body ownership increased

reinstatement of that event during retrieval in the hippocampus according to the vividness with which event details were retrieved. Our findings yield new insights into how to optimize memory and preserve the ability to vividly relive the past in the both healthy ageing and clinical disorders (e.g., Alzheimers Disease).

ID: 307

Feeling at home in a virtual body; Neural, behavioral, and phenomenal effects of the illusory embodiment of the desired body in Body Integrity Dysphoria

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Body integrity dysphoria (BID) is characterized by a discrepancy between the physical body and a phenomenal body lacking one or several limbs, often leading to the desire for limb amputation. Functional and structural alterations have been found in several brain regions, including the right superior parietal lobule (rSPL). Virtual reality (VR) and multisensory stimulation paradigms provide powerful tools to enable transient, illusory embodiment of the desired, i.e., amputated body.

Here, we used an fMRI block design to measure neural activity in response to seeing their body in the physical compared to the desired state before and after a VR intervention. In VR they played a game with an amputated body. The body was adapted to the desired shape and was seen from a first-person perspective and mimicked the participant's movements. Over 7 weeks before and after the experiment, we assessed clinical data using online questionnaires.

Preliminary analysis in 17 BID individuals (Age Mean | SD = 44.823 | 13.94, desiring left: 9, and right leg amputation: 8) and 12 controls (Age Mean | SD = 43 | 14.34) revealed stronger illusory embodiment in BID. Furthermore, BID individuals exhibited increased activity in rSPL before VR intervention compared to controls, specifically when seeing their amputated bodies. This significantly reduced after the intervention. This neural pattern was coupled with increased satisfaction with one's own body and amelioration of BID-related symptoms immediately and 2-3 weeks after the VR intervention.

Our results suggest that virtual embodiment might be exploited as a controlled, inexpensive, and safe way to cope with body dissatisfaction in BID.

ID: 167

Resting-state EEG predicts learning slope during virtual tool-use training in augmented reality and associated changes of body schema in healthy ageing

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We investigated whether resting-state EEG predict learning slope during and after tool-use training in augmented reality and whether such changes are associated with performance in tactile localization test (TLT) as indicator of embodiment and body schema plasticity. 34 young adults and 40 older adults underwent a virtual tool-use training in AR with and without vibro-tactile feedback and learned controlling a virtual gripper to grasp a virtual object. In the visuo-tactile (VT) condition compared with vision only (V), tactile feedback was applied to palm, thumb and index fingers through a CyberTouch II glove when the tool touched the object. Results of younger adults revealed a quadratic learning curve with a steeper learning slope for the VT than for the V condition while age effects are currently analyzed. Interestingly, the learning slope could be predicted from resting EEG alpha and theta power. Linear modeling revealed that relative theta power above central electrodes was positively related to learning ($F_{1,22} = 6.289$, p = .02, stand. estimate = .714). For alpha, higher parietal and lower frontal absolute power was marginally significantly associated with steeper learning slopes ($F_{1,22} > 2.96$, p < .099, stand. estimate = 1.426 and -1.883 for parietal and frontal alpha, respectively). Also, performance improvement in the TLT was associated with resting EEG power in the alpha band. Higher relative alpha above central electrodes again predicted better performance after tool-use training (VT condition) ($F_{1,8} = 5.169$, p = .053, stand. estimate = 1.399). Results of both ages and its association with body schema will be extensively compared and discussed.

ID: 166

Stand up for your brain: The effect of body posture on arousal, effort, and executive functions

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Humans are not evolved to spend most of their time sitting, thinking, and typing. Nevertheless, in most modern jobs, office employees typically perform intense mental work in an environment encouraging little physical activity. Prolonged seated work induces mental fatigue and can impair cognitive performance. In this talk, I present a study in which we tested whether alternation in body posture (in comparison to prolonged sitting) counteracts declines in arousal and performance. Participants worked on a battery of three executive functions tasks over two hours. This resulted in a global increase of self-reported fatigue and a global reduction of arousal over time, accompanied by impairments in working memory and overall performance in the flanker task and switch task. The effects of standing versus sitting were mainly observed locally, showing acute increases of arousal, EEG alpha desynchronization, a shift in sympathovagal balance in heart rate variability, and reduced self-reported effort costs. Standing also improved overall performance in the flanker task and drift-diffusion analyses show that this effect reflected an improved drift rate accompanied by a reduced non-decision time. Over time, HRV increased more rapidly in the alternating posture condition, suggesting it had a positive effect on vagal tone. These findings extend the growing literature on the positive effects of the use of sit-stand tables on physical health and reveal how and when an active body posture has beneficial effects on the body, brain, and body.

ID: 235

Keywords: EEG, P200, virtual architectures, body postures, arousal

The dynamic experience of arousing architectures influences the perception of emotional body postures: an EEG study in virtual reality

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An interesting but still unexplored question is how architecture influences the perception of others' affective states. Thus, we recorded event-related brain potential (ERPs) to characterize the processing time course of emotional body postures modulated by a dynamic architectural experience.

The electroencephalographic activity of fourteen subjects was recorded during an adaptation aftereffect paradigm in virtual reality. Subjects made a virtual promenade within architectures with different Form (low, high arousing) and Colour (cold, warm), and then judged the arousal level of an Avatar's body posture (low, middle, high arousal). Subjective ratings were analyzed through 2x2x3 repeated measure ANOVA, with within factors Form, Color, and Avatar. ERPs waveforms were analyzed in two separate time windows [0-300ms; 300-900ms] using a factorial mass univariate analysis with a permutation-based clustering correction.

Subjective ratings on avatars' bodily arousal were higher in the low arousing architecture (F(1,13)=6.689, p=0.022). The ERPs analysis returned significance for factors Form (p=0.045) in the early time window and Body (p=0.007) in the late one. Specifically, a higher P200 amplitude emerged over centro-parietal electrodes for avatars presented within low arousing architectures compared to high arousing ones (p =0.03). Also, high arousing avatars evoked a greater amplitude of Late Positive Potential over centro-frontal electrodes compared to low (p=0.017) and middle (p=0.009) ones.

Overall, results indicate that the dynamic experience of different architectures modulates the arousal judgement and P200 amplitude. This evidence may reflect a modulation of subjects' attention level towards emotionally relevant stimuli, thus showing how the architecture influences the perception of emotional body postures.

DECISION MAKING
Room: TC.5.13 Hörsaal

ID: 239

Keywords: social cognition, joint action, pupillometry, human-machine interaction, multiple object tracking

Coordination effort in joint action is reflected in pupil size

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Humans often perform visual tasks together, and when doing so, they tend to devise division of labor strategies to share the load. Implementing such strategies, however, is effortful as co-actors need to coordinate their actions. We tested if pupil size – a physiological correlate of mental effort – can detect such a coordination effort in a multiple object tracking task (MOT). Participants performed the MOT task jointly with a computer partner and either devised a

division of labor strategy (main experiment) or the labor division was already pre-determined (control experiment). We observed that pupil sizes increase relative to performing the MOT task alone in the main experiment while this is not the case in the control experiment. These findings suggest that pupil size can detect a rise in coordination effort, extending the view that pupil size indexes mental effort across a wide range of cognitively demanding tasks.

Partner choice in motion

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Prudently choosing who to interact with and who to avoid helps ensure that we benefit from a cooperative interaction. Do the motor parameters of the very actions used to implement a decision provide us with cues that are informative with regards to a co-actor's social preferences, thus informing us whether we should interact with or avoid them?

We used a partner choice paradigm in which participants partners for economic games (either prisoners' dilemma or stag-hunt). Before choosing between two partners, participants were presented with information about the potential partners' decision-related actions in another round of that same game. They received cues about the partners' action planning (Experiment 1, N = 144) or action execution (Experiment 2, N = 144). For both games, participants preferred those whose action planning indicated they were making cooperative decisions intuitively and those whose action execution indicated they were making cooperative decisions confidently.

We demonstrate that the motor parameters of an action can be used to estimate an actor's social preferences, granting the ability to know who to engage with and who to avoid. We discuss how these findings provide insights to the action observation system and its relation to humans' unique capacity for cooperation.

Risk and the body: Different risk taking profiles characterise restrictive eating and acceptance of cosmetic surgery

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Some individuals engage in high-risk restrictive eating to obtain their 'ideal body', while others engage in cosmetic surgery to change their appearance. Existing research has sought to understand the motivations behind such practices using self-report questionnaires and interviews; however, these methods are subject to several biases. Experimental methods can be used to measure performance beyond attitudes, with data amenable to advanced computational modelling, which can reveal latent processes underlying observable behaviours. In a series of studies, including a large sample of women with differing levels of restrictive eating (i.e. subclinical restrictive eating, acute anorexia nervosa [AN], and weight-restored AN patients), and women with differing acceptance of cosmetic surgery (including women who had undergone cosmetic procedures), we assessed risk taking with an experimental task, and used computational modelling to reveal whether risk or loss aversion was driving behaviour. We found that increasing levels of restrictive eating (including patients with acute AN) was associated with greater observable risk taking, driven by less risk aversion, especially when reward was coupled with a socially desirable thinner body. We further observed less risk taking driven by greater risk aversion when the outcome was an undesirable body. In separate studies involving two further samples, higher acceptance of cosmetic surgery (including women having undergone surgery), was associated with reduced risk taking driven by greater loss aversion. These findings indicate that different body modification practices are related to distinct patterns of observable risk taking, and these behaviours are driven by different motivations, such as risk versus loss avoidance.

Uncertainty deconstructed: a scoping review on the ERP correlates of risk and ambiguity

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Risk and uncertainty are central concepts in the neuroscience of decision-making. However, a comprehensive review of the literature shows that most studies define risk and uncertainty in an unclear fashion or use both terms interchangeably, which hinders the integration of the existing literature. We suggest that uncertainty is an umbrella term that comprises scenarios characterized by outcome variance where relevant information about the likelihood of outcomes may be somewhat unobtainable/unavailable (ambiguity), and scenarios where the likelihood of possible outcomes is known (risk).These conceptual issues are problematic for studies on the neuronal temporal dynamics of decision-making under risk and/or ambiguity, as they lead to heterogeneity in task design and in the interpretation of the results. To assess this problem, we conducted a scoping review of event-related potential (ERP) studies on risk and ambiguity in decision-making. By employing the definitions above to the 29 reviewed studies, our results suggest that: (a) studies manipulating risk are mainly descriptive-based, where participants are given specific information on the likelihood of different outcomes; (b) studies manipulating ambiguity are mainly experience-based, where the likelihood of outcomes must be inferred from experience; (c) ERP correlates of risk show that higher risk elicits increased amplitudes in centroparietal components – P2, P3; (d) ERP correlates of ambiguity show that higher ambiguity elicits increased negativity in frontal components – N1, N2, FRN.These results support the hypothesis that risk processing elicits cognitive/attentional processes while ambiguity processing elicits brain activity linked with the Anterior Cingulate Cortex, a core region for emotional signaling.

ID: 233

Acute stress influences decisions based on social and reward inference

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Adaptive decision making often requires people to take experienced consequences as well as social information such as advice into account. In everyday life, many decisions take place under stress or elicit stress themselves. Acute stress can modulate social inference and reward-based learning. However, little is known about the neurocomputational mechanisms that mediate stress effects on social inference and on the interplay or arbitration between social and non-social learning. Learning about other's intentions in advice giving (and, consequently, learning from advice) and reward-based learning rely on similar learning processes, which are, however, supported by partially different neural networks. To test whether and how stress affects these neural components and their interplay, we randomly assigned participants to a psychosocial stress or control manipulation before they performed a probabilistic learning task while we measured brain activity via functional magnetic resonance imaging (fMRI). In this task, participants had to learn from experienced rewards but also about the intentions of an advice-giver to optimally perform the task. Our behavioral data show that acute stress reduced learning performance and stressed participants relied less on social information. We will complement our initial analysis with behavioral modeling under a hierarchical Bayesian cognitive framework as well as with model-based fMRI analyses.

EMOTION AND FACE PERCEPTION

Room: TC.5.15 Hörsaal

ID: 221

Beware of this person! Psychophysiological responding to instructed and reversed threat persons

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Verbal instructions are an efficient way to learn about other people, whether they are helpful, trustworthy, or potentially dangerous. Interestingly, such verbal threat and safety learning can be easily changed by reversal instructions. This shift from threat to safety (and vice versa) is important for both appropriate social interactions and therapeutic interventions. Here, we examine verbal learning of shock threat or safety in a transdiagnostic dimensional sample ranging from healthy to highly anxious to severely traumatized participants. To date, 35 participants completed a combined threat-of-shock and reversal paradigm with four neutral faces serving as conditioned stimuli (CS+/CS-), while psychophysiological responding (e.g., startle reflex, SCR), interpersonal distrust, and self-reported ratings were assessed. Preliminary results confirm pronounced effects of instructed and reversed threat/safety learning. CS+ faces were perceived as more unpleasant, arousing, threatening, and distrustful compared to CS- faces. Moreover, threat-potentiated defensive reflex activity was observed at the physiological level. Interestingly, threat effects could be easily altered by means of repeated reversal instructions, and initial interactions between defensive responding and participants' anxiety levels emerged. In summary, socially acquired threat and safety associations

can be flexibly changed and updated by new information about others. Such reversal processes may vary with interindividual differences, especially among people with severe anxiety and stress-related symptomatology.

Cognitive demand drives dorsolateral prefrontal cortex activity during emotion recognition

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Dorsolateral prefrontal cortex (DLPFC) activity is strongly associated with emotion recognition. However, given the area's prominent role in executive control, it remains unclear whether this activity can be attributed to emotion processing or cognitive demand.

In our fMRI study 34 healthy adults completed a facial emotion recognition experiment including 3 conditions: Gender recognition with neutral faces (Gender Recognition), gender recognition with emotional faces (Implicit Emotion Recognition) and emotion recognition with emotional faces (Explicit Emotion Recognition). In ROI-based t-tests we analysed the BOLD contrasts [Explicit Emotion Recognition > Gender Recognition] and [Explicit Emotion Recognition > Implicit Emotion Recognition] in DLPFC bilaterally. We additionally calculated reaction time differences between Explicit and Implicit Emotion Recognition as a proxy for cognitive demand, which was forwarded to linear regression models predicting the BOLD response for Explicit Emotion Recognition in DLPFC bilaterally.

The t-tests revealed significant differences for all contrasts, indicating stronger DLPFC activity during Explicit Emotion Recognition. The linear regression models revealed a significant effect of cognitive demand on right DLPFC activity during Explicit Emotion Recognition, indicating that participants exhibiting a higher cognitive demand during the task also show stronger activation in the right DLPFC.

Our t-tests replicate findings of Geissberger et al. (2020), who conclude that DLPFC activity during Explicit Emotion Recognition indicates intentional processing of emotions. However, our linear regression analysis including the reaction time differences indicates that activity differences in DLPFC between emotion and gender recognition can – at least in part – be attributed to increased cognitive demand during emotion recognition.

Does representational momentum for dynamic emotional faces differ between happiness and anger? Preliminary results of a mnesic probe task

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Previous studies found that the offset of dynamic emotional faces is systematically displaced forward, into the immediate future. This effect is referred to as emotional anticipation and interpreted through the framework of representational momentum (RM), a perceptual phenomenon related to motion perception. Moreover, emotional anticipation seems to be stronger for human faces gradually changing from happy-to-neutral expressions than angry-to-neutral expressions, but evidence is scarce and limited to emotional ratings. Thus, we aimed to investigate RM for happy versus angry dynamic faces using a mnesic probe task, a paradigm commonly used in RM research. Sixty-six participants observed videos of happy/angry-to-ambiguous avatar faces. Each video was followed by a probe depicting the same expression as the final frame of the video (ambiguous) or one slightly changed to greater happiness/anger. Participants indicated whether the probe was equal to, or different from, the final frame of the video. Dependent variable was the direction of bias, calculated as the weighted mean of the proportion of equal responses, with positive values indicating forward bias (or RM) and negative values indicating backward bias. We found RM for both happy-to-ambiguous and angry-to-ambiguous faces, but no significant differences between conditions. In contrast to our hypothesis, these results suggest that RM magnitude for dynamic faces is not affected by their emotion in a mnesic probe task with avatars. Although further data are being collected, our preliminary findings provide new evidence on emotional anticipation and highlight the relevance of methodological decisions in RM research, particularly in the context of socioemotional events.

Emotion–not credibility–determines the cognitive effort invested in processing social misinformation

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Emotionality likely is a key factor affecting our susceptibility to misinformation. However, the mechanisms underlying this observation are not well understood. Specifically, when people derive social information from person-related news, they rely predominantly on the emotional contents, apparently unperturbed by the credibility of the media source. To help explain this bias, we here contrast two hypotheses of information processing reflected in changes in pupil size during news-based judgments: Affective and cognitive load processing. Thirty participants were first exposed to websites of well-known trusted or distrusted news media sources exhibiting headlines about unfamiliar persons, followed by social judgments. As expected, emotional relative to neutral headline contents lead to faster and more extremely valenced judgments. In line with the cognitive load hypothesis, pupil size was smaller for emotional compared to neutral news. Media source credibility did not modulate pupil size in response to emotional news. However, credibility modulated pupil size in response to neutral news, such that headlines from distrusted sources lead to larger pupils. This pattern of findings suggests that emotional contents yield fluent social judgments that are made with relatively little mental effort–even if based on untrustworthy news. Cognitive resources to evaluate the credibility of news may primarily be allocated when emotional contents providing (false) fluency are not available. In perspective, this insight into the biases underlying the processing of misinformation may be used as a protection against biased opinions and judgments.

ID: 336

Keywords: infant, maternal body odor, face categorization, multisensory development, EEG frequency tagging

The facilitating effect of maternal odor on rapid face categorization in the infant brain: A progressive decline over the first year

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The ability to visually categorize faces, a critical function for human social perception, undergoes dramatic changes during the first year of life. It was recently shown that another socially relevant signal for young infants, the mother's body odor, facilitates this developing visual ability in the 4-month-old brain. Here, we asked whether face categorization is still under maternal odor's influence in infants beyond age 4 months. To answer this question, we recorded scalp electroencephalograms (EEG) of 4 to 12 month-old infants (N = 50) during a rapid 6-Hz presentation of natural images (6 images/sec) depicting living and non-living objects. Faces were inserted 1/sec in the stream of visual stimuli to objectively measure a face-selective response at 1 Hz in the EEG spectrum. During stimulation, maternal and baseline odors were presented alternatively using a T-shirt worn by the infant's mother vs. an unworn T-shirt. We found that face-selective neural activity recorded over the occipito-temporal cortex increases with age, marking the development of face categorization. At the same time, the benefit of adding maternal odor appears to fade progressively. Therefore, the present study suggests a developmental trade-off between vision and olfaction to achieve social perception in the infant brain and supports the view that social perception is multisensory in infancy before unisensory cues become sufficient to optimally trigger the categorization of conspecifics.

Wednesday 20.07.2022
Symposia Slot II: 14:30 to 16:00 h

ID: 108
Room: TC.5.01 Hörsaal

Symposium
Keywords: Social motivation, prosocial behavior, costly helping

The righteous choice: The neurocognitive and neurocomputational mechanisms underlying moral conflict and social decision-making

Chair(s): Helena Hartmann ((a) Netherlands Institute for Neuroscience, Royal Academy of Arts and Sciences (b) Department of Cognition, Emotion, and Methods in Psychology, University of Vienna), Judit Campdepadros (Netherlands Institute for Neuroscience, Royal Academy of Arts and Sciences)

Discussant(s): Helena Hartmann ((a) Netherlands Institute for Neuroscience, Royal Academy of Arts and Sciences (b) Department of Cognition, Emotion, and Methods in Psychology, University of Vienna), Judit Campdepadros (Netherlands Institute for Neuroscience, Royal Academy of Arts and Sciences)

Previous research has shed light on how we understand and make decisions involving ourselves. However, everyday decisions are rarely made alone but critically depend on our social environment. Before making a choice, we need to consider its consequences and carefully weigh costs and benefits for oneself and for others. These choices, in turn, are often influenced by both bottom-up as well as top-down processes such as morality and empathy, and engage brain regions such as the temporoparietal junction (TPJ), the anterior cingulate gyrus (ACG) as well as the prefrontal cortex. Bringing together researchers that study the neurocognitive and neurocomputational mechanisms underlying moral decision-making, we aim to show the complexity of human social behaviour, when it comes to making decisions: Jo Cutler will talk about how people of different age groups exhibit differences in learning about actions and outcomes that affect ourselves and others. Lei Zhang will present evidence for the causal role of left TPJ in social influence during goal-directed learning. Complementing this, Jan Engelmann will demonstrate how anxiety influences our belief inferences in the TPJ during interactive economic games. Afterwards, Matthew Apps will target the consideration of effort and the role of the ACG to uncover the neural mechanisms of prosocial behaviour. Finally, Judit Campdepadros and Helena Hartmann will synthesise and discuss all findings and give an outlook on future research directions.

Presentations of the Symposium

Ageing is associated with disrupted reinforcement learning whilst learning to help others is preserved

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Reinforcement learning is a fundamental mechanism displayed by many species. However, adaptive behaviour depends not only on learning about actions and outcomes that affect ourselves, but also those that affect others. Using computational reinforcement learning models, we tested whether young (age 18–36) and older (age 60–80, total n = 152) adults learn to gain rewards for themselves, another person, or neither individual. Detailed model comparison showed that a model with separate learning rates for each recipient best explained behaviour. Young adults learned faster when their actions benefitted themselves, compared to others. Compared to young adults, older adults showed reduced self-relevant learning rates but preserved prosocial learning. Moreover, levels of subclinical self-reported psychopathic traits were lower in older adults and the core affective-interpersonal component negatively correlated with prosocial learning. These findings suggest learning to benefit others is preserved across the lifespan with implications for reinforcement learning and theories of healthy ageing.

A causal role of temporoparietal junctions in computing social influence during goal-directed learning

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The human temporoparietal junction (TPJ) is a crucial brain area for processing social information, and we have previously identified the neurocomputational function of bilateral TPJ in goal-directed learning (Zhang & Gläscher, 2020). Here, leveraging non-invasive continuous theta-burst stimulation (cTBS) and hierarchical Bayesian modeling, we tested whether bilateral TPJ causally supports the computation of social influence in a social learning task where participants were to adjust their decisions after observing choices from the others. Behaviorally, we show that disruption of the left TPJ weakened participants' choice adjustment and delayed their response speed when confronted with dissenting social information. Computationally, down-regulating activity in the left TPJ lesioned the degree of computing social influence during choice adjustment. Together, our results provide evidence for the causal role of left TPJ in social influence during goal-directed learning and shed light on the relational function of the TPJ in social cognition.

Anxiety suppresses activity related to belief-inferences during economic games in left temporoparietal junction

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Previous research suggests that the social cognition network can be disrupted by anxiety leading to reduced activity and connectivity within left TPJ. To test whether anxiety specifically disrupts mentalizing, we designed a novel version

of the classic false-belief task that explicitly requires participants to infer beliefs of interaction partners in economic games. Our participants made belief-based inferences under conditions of anxiety, induced via threat-of-shock. We assess the validity of the task by comparing activation patterns during the novel economic-games false-belief task to those during the classic story-based false-belief task and find significant overlap in left TPJ and dmPFC. Next, we assess the impact of anxiety on the integrity of the social cognition network and find a conjoint effect of mentalizing and threat in left TPJ during belief-inferences. These results provide direct evidence supporting the notion that anxiety suppresses activity in the left TPJ during belief-inferences in economic games.

Neural and computational mechanisms of prosocial and self-benefitting effort

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Prosocial decisions – choices to benefit others – are fundamental for a healthy society, with a growing understanding of the neural and cognitive mechanisms underlying them. However, existing work ignores a major factor that influences people's willingness to benefit others: effort. From holding open a door for a stranger, to helping a colleague with their work, being prosocial requires people to choose to exert effort for another's benefit. Here, participants made decisions about whether to exert different amounts of effort to obtain rewards either for themselves or for another person during fMRI. Using computational modelling in conjunction with representational similarity analysis we reveal a unique multivariate signature of effort in the anterior cingulate gyrus (ACCg) when making decisions to benefit others, as well as midbrain and Insula representations guiding self-benefitting choices. These findings provide insight into the neural mechanisms underlying prosocial acts and the ACCg's role in guiding such behaviours.

The ongoing quest to decipher the deciding brain

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The discussed research demonstrates the diversity in other-related decisions. Learning to benefit others is preserved, while self-related learning diminishes in healthy ageing. The left TPJ is causally involved in using social information when making decisions. It is also in TPJ where anxiety exerts a strong influence on how we make belief inferences in economic games. In addition, effort is an important factor in determining the outcome of prosocial decisions and its neural signature can be detected in the ACG. Future research from our lab tries to extend these findings, focusing on the causal role of the prefrontal cortex and how people learn to solve moral conflicts where one's own benefits are directly pitted against another's harm. Ongoing efforts will shed more light on the "deciding moral brain" and illuminate the influence that other people, effort, age and anxiety have on our decisions.

ID: 105
Room: TC.5.03 Hörsaal

Symposium
Keywords: facial feedback, EMG, Moebius, Morphine, NMES

Emotion and proprioception – taking a fresh look with a wider scope and new methodological advances

Chair(s): Sebastian Korb (University of Essex, United Kingdom)

Sensorimotor simulation, such as facial mimicry, occurs spontaneously in response to emotional stimuli and contributes to emotion recognition. Recently, however, aspects of the facial feedback hypothesis have been questioned. Research in this domain must thus strive to widen its scope, and advance methodologically, to unravel the neural mechanisms by which proprioceptive information influences responses to emotional stimuli. In this symposium, five early- to mid-career researchers take a fresh look at the role of facial feedback in emotion induction and perception. In contrast to most previous studies in the field that have relied on visual stimuli, results by César Lima, using EMG and the pen-in-mouth procedure, indicate facial feedback effects on emotional authenticity judgments also occur in the

auditory domain. The contribution by Paola Sessa shows how neuroplasticity and degeneracy lead to an alternative neural pathway for face processing in people with Moebius syndrome, and that sensorimotor simulation affects late stages of visual processing. Sebastian Korb will discuss the development of, and preliminary findings obtained with, a novel method of computer-controlled neuromuscular electric stimulation (NMES) to provide proprioceptive input to facial muscles with millisecond precision in the absence of motor output. Themis Efthimiou will present the effects of NMES, delivered with different intensities and at different time points, on the (mis)perception of emotionally ambiguous faces. Finally, Claudia Massaccesi will look at the link between facial mimicry and reward, presenting results of a pharmacological challenge of the mu-opioid receptor system through morphine administration on the mimicry and recognition of emotional faces.

Presentations of the Symposium

Do facial responses contribute to the processing of authenticity in auditory emotions?

César Lima
Iscte - University Institute of Lisbon

We often mimic the facial expressions of others in social interactions. Such responses reflect sensorimotor activity and are argued to provide cues for emotion recognition. Whether this mechanism is specific to faces or extends to auditory emotions remains unclear. I will present two studies, in which participants listened to laughs and cries that either reflected an authentic or a posed emotion, and evaluated these stimuli regarding their authenticity. Using facial electromyography, in Study 1 (N = 100) we found that authentic laughs evoked more spontaneous activity than posed ones in the zygomatics and orbicularis, and this activity predicted evaluations of authenticity. In Study 2 (N = 150), we found that reducing facial responses (by asking participants to hold a pen in their mouth) impaired the accuracy of authenticity recognition. Altogether, these findings point to a role of facial cues in the processing of authenticity in the auditory modality.

Putting sensorimotor simulation on the spot: Degeneracy in neural networks and sensorimotor-visual integration in facial expression processing

Paola Sessa[1], Arianna Schiano Lomoriello[2], Thomas Quettier[1], Pier Francesco Ferrari[3]
[1]University of Padova, [2]Denmark Technical University, [3]CNRS UMR5229

Influential theoretical models argue that an internal simulation mechanism (sensorimotor simulation) - involving facial mimicry - supports the recognition of facial expressions. I will describe studies by my group to clarify two critical aspects of this theoretical position. The first critical aspect refers to an argumentation against the simulation based on findings of patients with congenital facial palsy (Moebius Syndrome) showing normotypical performance in facial expression recognition/discrimination tasks. In this regard, I will discuss how our studies revealed that neuroplasticity and degeneracy lead to an alternative neural pathway in these patients when processing facial expressions. A second aspect regards the hypothesis that the sensorimotor simulation shapes the visual percept of a facial expression. In this regard, I will discuss our studies exploring the time-course of the interplay between visual face processing and sensorimotor simulation, demonstrating the impact of simulation during the latest stages of visual processing.

Using neuromuscular electric stimulation (NMES) to study social cognition

Sebastian Korb[1], Themis Efthimiou[1], Arthur Elsenaar[2], Marc Mehu[3]
[1]University of Essex, [2]Royal Conservatoire The Hague, [3]Webster Vienna Private University

Theories of embodied cognition propose that facial feedback can shape our feelings and contribute to emotion recognition by providing proprioceptive input that becomes integrated with the visual input of seeing a face. Largely due to methodological difficulties, few studies so far have however been able to isolate proprioceptive input from motor output, or vary the time at which proprioceptive input occurs with respect to the visual input. To be able to do so, we use computer-controlled facial neuromuscular electric stimulation (NMES). I will outline this novel method, the exciting opportunities it offers to investigate multisensory integration and to probe aspects of theories of embodied cognition, but also its associated challenges, e.g. in terms of participants' comfort or EEG artefacts. Finally, I will summarise recent findings of my lab on the effects of facial NMEs on mood in healthy subjects.

Tuning emotional face perception with facial neuromuscular electrical stimulation (NMES)

Themis Efthimiou[1], Marc Mehu[2], Arthur Elsenaar[3], Sebastian Korb[1]
[1]University of Essex, [2]Webster Vienna Private University, [3]Royal Conservatoire The Hague

Proprioceptive input from facial muscles is thought to contribute to facial emotion recognition, possibly by modulating visual perception. However, several questions remain, such as when during face processing facial feedback effects are most pronounced. We investigated this question in healthy subjects using facial neuromuscular electrical stimulation (NMES). Short (500ms) proprioceptive inputs were delivered with different intensities (50% and 100% of motor threshold) to the zygomaticus major and depressor anguli oris facial muscles, immediately before and during the presentation of faces displaying weak levels of happiness or sadness. Participants' emotion categorisation responses were analysed using psychophysics to establish when and at what intensity facial proprioceptive input needs to occur in order to modulate emotion recognition. Neural correlates were assessed with EEG. Preliminary results will be presented.

Effects of the mu-opioid receptor agonist morphine on facial mimicry and emotion recognition

Claudia Massaccesi[1], Sebastian Korb[2], Matthaeus Willeit[3], Boris B. Quednow[4], Giorgia Silani[1]
[1]University of Vienna, [2]University of Essex, [3]Medical University of Vienna, [4]University of Zurich

We tested if the mu-opioid receptor (MOR) system, which is known to play a key role in affiliation and social bonding, underlies facial mimicry and emotion recognition – two abilities that support adaptive socio-emotional behaviour, and promote affiliation and the establishment of social bonds. Using a randomized, placebo-controlled, double-blind, between-subjects design, we investigated in 82 healthy human volunteers the effects of the specific MOR agonist morphine on the recognition accuracy of emotional faces, and on their facial mimicry measured with EMG. Compared to placebo, morphine reduced mimicry of fear, but did not affect the recognition or mimicry of happy and angry facial expressions. These findings suggest that the MOR system is involved in automatic facial responses to fearful stimuli, but not in their identification. The results also suggest that previously reported effects of non-specific opioid agonists and antagonists on fear recognition are potentially explained by kappa- rather than mu-opioid receptor modulation.

ID: 112
Room: TC.5.05 Hörsaal

Symposium
Keywords: Interoception, methodology, insula, mental health, somatosensation

New challenges and frontiers in interoceptive research

Chair(s): Laura Crucianelli (Karolinska Institutet, Sweden), Esra Al (Max Planck Institute for Human Cognitive and Brain Sciences)

Interoception relates to the sensing of internal feelings, informing the organism about its bodily needs. The impact of interoception extends beyond homeostatic regulation and survival, and relates to self-awareness and higher cognitive functions. Traditionally, interoceptive signals have been primarily quantified using heartbeat detection tasks. However, an increasing number of studies are using alternative methods to measure interoception, improving existing tasks and/or developing novel methodologies focused on different bodily signals. Here, we will combine our diverse expertise to explore challenges, novel strategies, and potential clinical implications in the growing field of interoception. Dr Murphy will provide an overview of the pitfalls of some interoceptive measurements and which strategies can be used to overcome such challenges. Dr Crucianelli will discuss some of the arguments and novel evidence supporting the study of interoception by means of skin-mediated signals, with a particular focus on thermosensation. Dr Al will demonstrate how internal bodily signals, such as heartbeats, can promote information processing by uniquely influencing human perception and action. Finally, Professor Garfinkel will present the results of a interoceptive training study in anxiety in autistic adults, showing that this training led to greater interoceptive precision, a decrease in anxiety, and enhanced associated insula connectivity. Taken together, this symposium will integrate physiological, behavioural, neural, and clinical evidence supporting the scientific study of interoception. Combing these diverse approaches can foster our understanding of the mechanisms underpinning the perception of interoceptive signals and pave the way for future experimental and clinical applications.

Presentations of the Symposium

The measurement of interoception: challenges and novel methods

<u>Jennifer Murphy</u>
Royal Holloway, University of London

Despite great interest in interoception, measuring interoception remains a challenge. Focusing on cardiac interoceptive accuracy and self-reported interoception, in this talk I will discuss some of the pitfalls of interoceptive measurement and how these may be mitigated. I will outline how novel methods may serve to overcome challenges, providing new insights into the structure of interoception and its clinical relevance.

An interoceptive take on touch and temperature

<u>Laura Crucianelli</u>
Karolinska Institutet, Stockholm

Interoception includes signals from inner organs and certain signals from the skin providing information about the body's physiological state. The functional relationships between interoceptive submodalities is unclear, and thermosensation as skin-based interoception has rarely been considered. We used a battery of five tasks to examine the relationships of cardiac interoception, thermosensation, affective touch and nociception. Thermosensation was probed with a classic temperature detection task and a new task, *the dynamic thermal matching task,* where participants match a previously perceived moving thermal stimulus to a range of colder/warmer stimuli around thermoneutrality. We also examined differences between hairy and non-hairy skin and found superior perception of dynamic temperature and static cooling on hairy skin. Noteworthy, no significant correlations were observed across the interoceptive sub-modalities accuracies (except for cold and pain perception in the plam), which indicates that interoception should be conceptualized as set of relatively independent processes rather than a single construct.

Cardiac signals impact somatosensory perception and motor activity

<u>Esra Al</u>
Max Planck Institute for Human Cognitive and Brain Sciences

Internal bodily signals such as heartbeats can influence human perception and action. For instance, in a series of behavioral and EEG experiments, we have shown that somatosensory perception is impaired both during the systolic phase of the cardiac cycle and when heartbeats evoke strong cortical responses. Using simultaneous EEG-TMS, we further investigated whether these cardiac effects originate from general changes in excitability. In the motor domain, we observed that systolic cardiac signals have a facilitatory effect on motor excitability – in contrast to sensory attenuation that was observed for somatosensory perception. This suggests that action and perception have distinct windows in the cardiac cycle for optimal information processing. Further investigation of these cardiac effects in clinical conditions, e.g., anxiety and depression, can lead to clinical interventions, issues to be investigated in future studies.

Interoceptive training reduces anxiety and enhances interoceptive accuracy and insula connectivity

Sarah Garfinkel
University College London

Anxiety is highly prevalent in autistic individuals, where around 60% of autistic adults have comorbid anxiety. Differences in interoceptive processing have been observed in autistic individuals and interoceptive errors are implicated in the aetiology of anxiety. In a registered clinical trial, autistic adults (N=121) were randomly assigned to either an interoceptive training group or an exteroceptive active control intervention (emotional prosody training). A statistically significant group effect of interoceptive training was observed at 3-month follow-up (estimated mean difference 3.23 [95% CI 1.13 to 5.29]; d =0.30 [95% CI 0.09 to 0.51]; p=0.005) with 31% of the interoceptive group participants meeting trial criteria for recovery. Decreases in anxiety in the interoceptive training group persisted at one-year follow-up. Insula functional connectivity was significantly enhanced with interoceptive training (p<0.05, FDR corrected). These results suggest that greater interoceptive precision and enhanced associated neural connectivity can help with autonomic control to alleviate anxiety.

ID: 119
Room: TC.5.13 Hörsaal

Symposium
Keywords: dance, neuroaesthetics, social cognition, emotion, beauty

Emerging multi-disciplinary perspectives and cutting-edge advancements in dance neuroaesthetics.

Chair(s): Kohinoor Monish Darda (Institute of Neuroscience and Psychology, University of Glasgow, Scotland; Department of Cognitive Science, Macquarie University, Sydney, Australia; Penn Center for Neuroaesthetics, University of Pennsylvania, Philadelphia (PA), USA), Andrea Orlandi (Department of Psychology, Sapienza University, Rome, Italy; IRCCS Santa Lucia Foundation, Rome, Italy)

Two decades after the first neuroscientific investigations on dance, we are witnessing an increase in dance aesthetics studies brought forth by international teams, and supported by significant grants (e.g., ERC, MSCA). Emerging perspectives and technical advancements have paved the way for a neuroscience of dance that has implications across multiple fields. The present symposium gathers world-renowned laboratories investigating a broad range of topics in dance neuroaesthetics using cutting-edge multi-method techniques and approaches. Exploring both the dancer's and the audience's perspectives, and using behavioural, physiological, and electrophysiological measures, these labs seek to answer some of the most fundamental questions in the arts and sciences: 1) Is dance appreciation universal across cultures, and what is the effect of cultural familiarity? (Dr. Christensen); 2) How does dance expertise and body awareness modulate every-day emotion perception? (Dr. Meletaki); 3) Are dance productions made by artificial intelligence valued in the same way as human-created art? (Dr. Darda); 4) What is the role of interpersonal complexity when perceiving dancing dyads? (Dr. Orlandi); and 5) Are the audience's brains and bodies in synchrony while watching live dance performances (Dr. Rai)? All presentations will start from the common ground of acquired expertise and move into innovative and fascinating domains of application, touching on key and timely issues of open science, moving beyond WEIRD populations, and two-person neuroscience. Ultimately, our symposium will highlight future implications and benefits not only for the domain of dance aesthetics, but also social cognition, affective neuroscience, computer science, vision science, artificial intelligence, and out-of-the-lab empirical aesthetics.

Presentations of the Symposium

Is dance appreciation universal? The role of representation, expertise, and culture in aesthetic responses to Indian and Western classical dance.

Kohinoor Monish Darda[1], Emily S Cross[2]
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Dance represents one of the few areas in society where people come together to share experiences even when they have radically different worldviews. But to what extent can dance transcend boundaries of culture or country? Do

our in-group biases and preferences persist when watching dance? We investigated whether representational dance is preferred to abstract dance, if participants from one culture prefer watching dance from their own culture compared to another, and how these preferences are modulated by dance expertise. Our results show no preference for representational dance across Indian and Western participants. An ingroup bias exists, but only in Western dance-naïve participants, and not in Indians. The current findings both inform and constrain understanding of the universality of aesthetic judgements, and 1) caution against generalising models of aesthetics to non-western populations, and across art forms, and 2) highlight the importance of art experience as a means of countering prejudices.

Experts feel it all: Brain- heart interplay and the role of dance expertise on facial emotion expression and interoception

Vasiliki Meletaki[1], Bettina Forster[2], Beatriz Calvo-Merino[2]
[1]Cognitive Neuroscience Research Unit, Department of Psychology, City, University of London; Laboratory of Cognitive Neuroscience, CNRS – Aix Marseille University, [2]Cognitive Neuroscience Research Unit, Department of Psychology, City, University of London

Previous studies have well established the dance expertise modulation on neural and psychophysiological responses to familiar emotional dance movements. In the current studies we questioned whether this expertise effect is domain specific or can be generalised to everyday facial emotion expressions. Professional dancers and controls performed a visual emotion and gender discrimination task on emotional faces (happy, neutral and afraid) while recording their neural and cardiac activity. Their interoceptive abilities and levels of alexithymia, depression and anxiety were measured. Visual Evoked Potentials were registered over the occipital cortices, Somatosensory Evoked Potentials over the somatosensory cortices (following tactile stimulation in 50% of the trials, see Sel, Forster and Calvo-Merino, *JoN* 2014) and Heartbeat Evoked Potentials over the fronto-central areas. Our results provided strong evidence for domain general expertise effect when comparing the visual, somatosensory and heartbeat evoked potentials on facial emotion expressions and body awareness for professional dancers and control participants.

Cross-cultural empirical aesthetics of dance

Julia F. Christensen[1], Shahrzad Khorsandi[2]
[1]Max-Planck-Institute for Empirical Aesthetics, Frankfurt/M, Germany, [2]Shahrzad Dance Academy, San Francisco, Bay Area, USA

We present the Persian Dance Movement Library (PDML), along with the results from several cross-cultural online validation experiments. The PDML contains 20 custom-choreographed dance sequences of six-seconds length (8 counts), danced five times each, with a different emotional intention by the dancer at each repetition (joy, anger, fear, sadness, neutrality; stimuli N=100). Perceptual ratings were obtained from N=322 human observers from two cultures (Iranian, English). While Emotion Recognition (ER) rates were relatively low for these stimuli, ratings of Expressivity, Beauty and Liking differed significantly between the emotion categories, suggesting that, perceptually, participants differentiated the emotional intentions of the dancer, even if labelling these according to classical emotion categories was difficult. To investigate the effect of cultural familiarity, participants also filled in an enculturation questionnaire. Enculturation modulated all perceptual judgments. Results are discussed in the context of literature in the affective sciences and of cross-cultural empirical aesthetics.

Interpersonal complexity in dance aesthetics: the role of objective and subjective features

Andrea Orlandi, Matteo Candidi
Department of Psychology, Sapienza University, Rome, Italy; IRCCS Santa Lucia Foundation, Rome, Italy

Dance represents an ideal framework for neuroscientific studies on body and action representation and appreciation. A strong link between aesthetic appreciation, previous expertise, and movement's features has been previously reported. Most studies on dance stimuli focused on single body perception and only recently on group aesthetics. The current project investigates aesthetic, emotional, and semantic responses to non-symbolic postures of body dyads varying on several visuospatial attributes (e.g., shared interpersonal space, orientation, and symmetry). A dance-inspired training was used to create virtual stimuli by digitalizing dancers' movements. In four studies, subjective evaluations and observers' dispositional traits and preferred interpersonal distance were collected. Our evidence indicates that the aesthetic appreciation of interactions critically depends on the level of shared interpersonal space and the observers' focus towards low-level (symmetry) vs high-level (emotion, meaning, interest) dyads' features. Such an aesthetic experience is strongly linked to both the observer's subjective attributes and stimuli' visuospatial characteristics.

Shared brain activity in large groups while watching live dance: A mobile-EEG Hyperscanning study.

Laura Rai[1], Haeeun Lee[1], Federico Calderon[1], Jamie Ward[2], Guido Orgs[1]
[1]Department of Psychology, Goldsmiths, University of London, United Kingdom, [2]Department of Psychology, Goldsmiths, University of London, United Kingdom; Department of Computing, Goldsmiths, University of London, United Kingdom

Watching live performance is an inherently social activity wherein people often share highly emotional experiences. Yet, neuroscientific research into music/dance cognition and appreciation has been almost exclusively conducted on individuals in a lab-setting. Across four live performances of dance choreography ('Detective Work') we measured real-time dynamics between brains of groups. We recorded 32-channel mobile-EEG and respiratory activity from upto 23 spectators simultaneously (total N=92), assessing spectators' mood, personality, dance experience, and engagement with performance. We compute Inter-brain connectivity to measure brain and body synchrony between spectators relative to an active resting-state baseline. We predict brain synchrony will a)increase with audience engagement, b)vary with structural features of choreography and c)depend on individual differences between spectators, such as their dance experience. To our knowledge, this is the largest hyperscanning study of

simultaneous wet-electrode EEGs to-date. Our findings contribute towards understanding neural mechanisms of sharing attention and affect in large groups of people.

ID: 116
Room: TC.5.15 Hörsaal

Symposium
Keywords: Human chemosignals, body odors, olfaction, social connection, wellbeing

Social connection & the nose: how human chemosignals contribute to wellbeing

Chair(s): Cinzia Cecchetto (University of Padova, Italy), Valentina Parma (Monell Chemical Senses Center, Philadelphia, USA)

Lack of social connection is a phenomenon with serious consequences for cognition, emotion, and health, culminating with the increased chance of early death by 20%. Sensory impairment is associated with reduced social connection, though the role of olfaction in the process is understudied. Here we focus on the contribution of the chemosignals present in human sweat to foster social interaction and connection via sharing a wealth of information about an individual's identity (e.g., age, gender, ethnicity, health status, and sexual availability) and emotional states and traits. The proposed symposium will offer new insights on how human chemosignals can foster sociality across a variety of human relational contexts and developmental stages. Dr. Schäfer will provide evidence of the role human chemosignals play in facilitating and strengthening baby-mother relationship. Inbal Ravreby will show data suggesting that body-odor similarity between two people can promote friendship. Dr. Leleu will examine the influence of human chemosignals on face perception, a core component of human social cognition. Dr. Ferdenzi will investigate the psychophysiological effects of positive human chemosignals, an understudied area of research. Finally, Elisa Dal Bò will explore the perception of human chemosignals in the case of altered social competence, specifically in individuals with social anxiety and depression. Altogether, these contributions will leverage different methodological approaches, populations and perspectives to demonstrate how human chemosignals promote healthy social connection.

Presentations of the Symposium

Children's body odours in the parent-child relationship - signals of kinship and affection

Laura Schäfer
Klinik und Poliklinik für Psychotherapie und Psychosomatik, Technische Universität, Dresden, Germany

Kin recognition and affective perception of infants' multisensory signals are prerequisites for a close positive bond between parents and children. Children´s body odours serve as effective biological signals in this context. Our current research provides an overview of how children´s body odours mediate parental recognition and preference of one's own child over unfamiliar children and how these phenomena change with the developmental span of the child. It will also be presented how both, olfactory recognition and preference are related to the child's genetic and hormonal status and whether mothers and fathers differ in their perception of children´s chemosignals. In addition, fMRI data will be presented to understand how children's body odours are represented in the parental brain. A particular look at neural activations in pleasure and reward areas will help to understand whether infant body odours trigger specific responses in parents, or may also act as universal signals of cuteness.

There is Chemistry in Social Chemistry

Inbal Ravreby
Department of Brain Sciences, Weizmann Institute of Science, Israel

Non-human terrestrial mammals sniff themselves and each-other, to decide who is friend or foe. Humans also sniff themselves and each-other, but the function of this is unknown. Because humans seek friends who are similar to themselves, we hypothesized that humans may smell themselves and others to subconsciously estimate body-odor similarity, that in-turn may promote friendship. We recruited non-romantic same-sex friend-dyads, and harvested their body-odor. We found that objective ratings obtained with an electronic nose, and subjective ratings obtained from independent human smellers, converged to suggest that friends smell more similar to each other than random dyads. Finally, we recruited complete strangers, smelled them with an electronic nose, and engaged them in non-verbal same-sex dyadic interactions. We observed that dyads who smelled more similar, had more positive dyadic interactions. In other words, we could predict social bonding with an electronic nose. We conclude that there is indeed chemistry in social chemistry.

Chemical communication of positive emotions in humans

Camille Ferdenzi[1], Stéphane Richard[1], Olivia Carlos[2], Aline Robert-Hazotte[2], Bénédicte Race[2], Moustafa Bensafi[1]
[1]Lyon Neuroscience Research Center, Lyon, France, [2]Shiseido Group EMEA, Paris, France

Humans can communicate their emotions to others via volatile emissions from their bodies. Although there is now solid evidence for human chemical communication of fear, stress and anxiety, investigations of positive emotions remain scarce. In this talk, I will present a series of studies examining the autonomic, verbal, and behavioral responses of receivers exposed to axillary odors of donors having undergone a positive and a neutral mood induction procedure.

The question how perfume interacts with chemical communication was also addressed. A first study using video inductions showed a decreased heart rate and increased performances in creativity tasks in response to 'positive' body odors compared to 'neutral' ones. I will also present the results of a second study using a protocol aiming at increasing the ecological relevance of our approach, by using virtual reality to induce emotions.

Learning to see faces with the nose

Arnaud Leleu
Université Bourgogne Franche-Comté, Dijon, France

Infants must rapidly develop the ability to perceive conspecifics across the senses to engage in social interaction. Does olfaction, an early-maturing sense, drive social perception in later-developing senses, such as vision? Here, I will address this issue through a series of experiments using scalp EEG, and demonstrate that one of the most relevant social odors for young infants, the mother's body odor, shapes face perception in the developing brain. I will show that maternal odor enhances face-selective neural activity in the 4-month-old brain, this effect being absent for nonface objects, except for objects that can be perceived as faces (face pareidolia). I will also show that the odor effect decreases between 4 and 12 months as face perception becomes more efficient. These findings will disclose how the infant brain builds upon the first odor learned during mother-infant interactions to apprehend the social environment in the less mature sense of vision.

Emotional body odors processing in social anxiety and depression

Elisa Dal Bò[1], Claudio Gentili[1], Francesca Mura[1], Alejandro Luis Callara[2], Luca Citi[3], Nicola Vanello[2], Enzo Pasquale Scilingo[2], Alberto Greco[2], Cinzia Cecchetto[4]
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Human body odors have been shown to be an effective modality of social communication. Importantly, individuals exposed to emotional body odors report a partial reproduction of the affective state of the sender. This phenomenon is particularly relevant in conditions in which social interactions are impaired, as in depression and social anxiety. Here I will present a high-density EEG study in which we investigated how body odors collected in a happiness and a fearful condition can modulate the subjective perceptual experience and the neural processing of neutral faces in individuals with symptoms of depression, with symptoms of social anxiety, and healthy participants as controls (for each group N = 25). With the results of this study, I will provide a psychophysiological framework of the role of both happiness and fear body odors in affective disorders. A potential role of body odors in the treatment of these disorders will also be discussed.

Wednesday 20.07.2022
Oral Presentations Slot II: 17:00 to 18:30 h

EMPATHY
Room: TC.5.01 Hörsaal

ID: 289

Keywords: EEG, empathy for pain, CU traits, aggressive behaviour

Empathy for pain and aggression among young adult men and women: an EEG Study

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Observing someone else in pain elicits a neural response similar to that when one experiences pain, which is often taken as a neural marker of human empathy. Notably, this natural response to the perception of others' pain (also known as empathy for pain) is disrupted in people with callous-unemotional (CU) traits – characterised by serious empathy deficits –, who also have higher risks for violent aggressive behaviour (Muñoz and Frick, 2012). However, results on the relationship between empathy for pain and aggressive behaviour in this cohort have been mixed, and most studies purely focus on male populations. To build on previous research and address this gap, we employed a passive viewing approach to track participants' electrophysiological/EEG activity while they observed pictures of body parts in painful vs. non-painful situations. Analyses were based on a male and female young adult sample (M = 23.3 years) characterised by their levels of CU traits, empathic skills, and aggressive tendencies. Consistent with previous research, preliminary results show increased N1 and P3 EEG amplitudes during exposure to painful stimuli (with maximal distribution over frontoparietal and centroparietal areas, respectively). As predicted, these effects in brain signal varied across individuals who showed differences in CU traits. We further observed a link between CU traits and aggressive tendencies in female participants. Broadly, these findings may suggest that empathy for pain plays a

greater role in modulating aggressive behaviour in women than in men, which provides a novel insight into sex differences in empathy as related to behaviour.

I see you: Seeing one's partner in online emotional communication enhances the perceptions of togetherness, being heard, and empathy

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Online communication is booming, enabling people to choose how they connect with family, friends, patients, colleagues, and others—and various platforms allow people to both see and hear their social partner if they so choose. This study examines the contribution of seeing the other person during social-emotional communication versus hearing alone. Although past studies have claimed that facial expressions are essential for emotion recognition, more recent studies imply that the audio and semantic information may be sufficient in order to accurately understand the other's emotional state. In two dyadic ecological studies (a total of 478 participants, 239 pairs), we investigated this effect on the Zoom platform, asking one participant to tell an emotional story, while the other listens, with cameras either on or off. They then both reported on emotional and social aspects of their experience. These studies indicate that seeing the other does not improve accuracy compared to just hearing them, even in a live interaction. However, seeing one's social partner enhances the overall affective experience: the perception of togetherness, being heard, and receiving empathy from the listener. Moreover, the visual layer may even increase emotional sharing between conversation partners. These findings have direct implications for various social-interaction contexts, especially as online communication continues to permeate daily life.

Investigating the Relationships between Empathy and Executive Functions in Early Adolescents

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Empathy and executive functions (EF) are two multi-modal abilities that enable individuals to cope with their environment. Both abilities keep developing throughout childhood and were found to contribute to social behavior and academic performance in young adolescents. Notably, EF and mentalizing activate shared fronto-temporal areas of the brain, which has driven previous studies in adults to suggest that at least some aspects of empathy depend on intact EF mechanisms (e.g., self-other differentiation and shifting attention to another person). However, and despite the substantial changes in empathy and EF during adolescence, no study to date has systematically examined the association between sub-components of empathy and EF in this age group. In this study, we used an online battery of tasks collected as part of a longitudinal study (N=538; Mean age 10.8±0.4). Using a confirmatory factor analysis, we quantified the associations between two main empathy components (mentalizing and interpersonal concern), and EF components (working memory, inhibition, and shifting). We found that working memory was mildly related to mentalizing (β = .25, p = 0.018) and interpersonal concern (β = .21, p = 0.013), whereas no associations were found between inhibition or shifting and empathy. Our findings suggest that WM is associated not only with the cognitive but also with the emotional aspect of empathy. These findings deepen our understanding of the association between cognition and emotion during development, and may have implications for EF related interventions in promoting social behavior in adolescence.

Reduced affective Empathy in Women on Oral Contraceptives: a cross-sectional fMRI Study

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Oral contraceptive (OC) intake inhibits ovulation and suppresses endogenous ovarian hormone levels. Sex hormones cross the blood-brain-barrier and bind to receptor sites in brain regions involved in socio-affective processing. Evidence is accumulating that OC-intake modulates a variety of different socio-affective behaviours including some empathic abilities. The aim of this study was to investigate the potential role of OC-intake in cognitive as well as affective empathy and their neural correlates.

In a cross-sectional fMRI study, women in different hormonal states including OC-intake (OC users: n=46) or being naturally cycling in the early follicular (fNC: n=37) or peri-ovulatory phase (oNC: n=28), performed a sentence-based empathy task including positive and negative emotions.

Behaviourally, OC users had generally significantly lower empathy ratings than oNC women. Congruently, significantly lower task-related activation of several brain regions including the left dorsomedial prefrontal gyrus, left precentral gyrus, and left temporoparietal junction were observed in OC compared to oNC women. Lower activation of the left dorsomedial prefrontal gyrus and precentral gyrus were associated with lower affective empathy ratings as well as self-reported empathic concern in OC women, respectively. Moreover, empathy-related brain activation was negatively associated with synthetic hormone levels.

Overall, this multimodal cross-sectional investigation of empathy suggests a role of OC-intake in especially affective empathy. Furthermore, it highlights the importance of including synthetic hormone levels in OC-related analyses for a better understanding. OC-related effects on affective empathy could have implications on social behaviours as well as relations and thus should be considered when making contraceptive choices.

ID: 219

The interplay between psychopathy, antisocial behaviour, and empathy: meta-analytical evidence across different conceptual frameworks

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Empathy impairment is widely considered a hallmark of psychopathy and a risk factor for antisocial outcomes. However, a fine-grained conceptualization addressing how empathy domains (cognitive and affective) may be differentially associated with antisocial behaviour and psychopathy dimensions was lacking. We conducted a comprehensive meta-analysis (477 records, n = 142,692) to examine the complex interplay between psychopathy, antisocial behaviour, and empathy domains. Group-based analyses indicated that cognitive empathy was more compromised in antisocial groups, $g_{cognitve}$ = -.43 vs. $g_{affective}$ = -.11, while deficits were larger for affective empathy in high psychopathy samples, $g_{affective}$ = - .40 vs. $g_{cognitive}$ = -.22. Correlational analyses were used to examine the specific associations between empathy domains and psychopathy dimensions across conceptual frameworks. Effect sizes for antisocial-related psychopathy traits were mostly mild, r = [-.03, -.21], while callous-affective traits were associated with a broad empathy impairment, $r_{affective}$ = [-.34, -.46]; $r_{cognitive}$ = [-.26, -.27]. The interaction between interpersonal traits and empathy was different across conceptual models, as boldness-adaptive manifestations were unrelated to cognitive empathy, r = .03, while nonadaptive interpersonal traits were negatively associated with both empathy domains, $r_{cognitive}$ = -.16; $r_{affective}$ = -.25. Overall, psychopathy and antisocial behaviour displayed distinct empathic profiles, suggesting that these constructs should not be clustered together. Moreover, psychopathy dimensions were differentially associated with cognitive and affective empathy, suggesting a complex role of the social brain on the etiological pathways of psychopathy. Finally, these findings indicate that multidimensional psychopathy frameworks provide a useful approach to dissociate cognitive and affective empathy from a behavioural and neuronal standpoint.

SOCIAL PERCEPTION
Room: TC.5.03 Hörsaal

ID: 189

Attention allocation in complementary joint action: how joint goals affect spatial orienting

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Successful joint action often requires individuals to attend and respond to the same spatial location in complementary ways (e.g., when one person puts down a mug with a precision grip and another person picks it up with a whole-hand-grip). At the same time, the spatial relation between individuals' actions affects attentional orienting: one is typically slower to attend and respond to locations another person previously acted upon than to locations nobody acted upon; a phenomenon known as the "social inhibition of return" (social IOR). In joint actions, however, returning to a co-actor's location can be imperative to achieving joint goals (e.g., passing a mug). This raises the question of whether attentional orienting, and hence the social IOR, is affected by the goal of our actions. The present study

aimed to answer this question. Participants responded to cued locations on a computer screen, taking turns with a virtual co-actor. They either pursued an individual goal or performed complementary actions with the co-actor, in pursuit of a joint goal. Response time results of four experiments consistently showed that the social IOR was significantly modulated when participant and co-actor shared a joint goal. In line with research on top-down attention, this suggests that attentional orienting is affected not only by the spatial but also by the social relation between individuals' actions. Our findings extend previous research on interpersonal perception-action effects, showing that the way another person's perceived action shapes our own depends on whether we share a joint goal with that person.

ID: 331

Perceptions of others' social affect and social cognition influences prosocial behavior

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Prosocial behaviour is fundamental for cooperation in societies. But how do we decide with whom to cooperate? We investigated the role of subtle social signals and context cues in promoting prosocial behaviour. In three experiments (N=486), participants witnessed short pre-recorded conversations between a Speaker and a Listener. Participants could hear (but not see) the Speaker telling either a negative or a neutral autobiographical episode (valence manipulation) and see the Listener, who looked either directly into the camera (direct gaze condition), downwards (averted gaze condition) or switched between direct and averted gaze (mixed gaze condition). Subsequently, participants rated their impression of empathy and perspective-taking of the Listener in the conversation and played the Trust Game (study 1) or the Dictator Game (study 2, preregistered) with the Listener. We observed that Listeners' occasional gaze avoidance, especially during emotionally negative conversations, increased participants' perceived social understanding of the Listener and subsequent prosocial behaviour towards them. This suggests that subtle cues in social interactions might serve as an indication of another's reputation, thereby promoting indirect reciprocity. In a third study (preregistered) we tested whether results could also be explained by social contagion. Participants performed the same task, but were asked to play a Dictator Game with an unknown person. We observed increased generosity towards strangers after participants observed Listeners demonstrating social understanding while hearing negative conversations. We conclude that subtle cues in social interactions influence prosocial behaviour through both indirect reciprocity and social contagion, although the effects on social contagion were less pronounced.

ID: 349

Sexualization: the Role of Attentional Biases, (Dis)similarity and Animalistic and Mechanistic Dehumanisation

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Even though the link between sexualization and increased hostility towards sexualised individuals has been established in various studies, the mechanisms that could explain this relationship remain to be elucidated. In our study, we investigated attentional biases towards sexualised body parts, animalistic and mechanistic dehumanisation and (dis)similarity as possible proximate mechanisms of objectifying sexualised individuals. Several novel implicit measures of dehumanisation and (dis)similarity were combined with classical measures of dehumanisation and (dis)similarity. Eyetracking technology was used to track visual exploration patterns of sexualised and non-sexualised individuals. A mousetracking task makes it possible to account for implicit negative attitudes towards sexualised men and women. Eventually, I will provide an outlook on implementing these measures in an fMRI experiment. By applying an empathy for pain paradigm, we further assess the relationship between sexualisation and reduced (neural) empathic responses and the potential consequences on (pro)social behaviour.

ID: 293

Social interaction matters: Human behavior and cognition beyond the individual

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Do the dynamics of real-time social interactions, in and of themselves, shape our behavior and cognition beyond our awareness? Or merely believing we interact is enough to induce analogous processes? These questions are part of a hot debate cutting across various fields, from neuroscience to philosophy. However contradictory the arguments may have been so far; they are all largely grounded in strong hypothetical assumptions. To operationalize and put to the test the questions at hand empirically, here, we deploy 'two-person psychophysiology', as an empirical framework which aims at measuring and analyzing the multiscale dynamics of social interaction. More concretely, in our experiments, participants sit 'face-to-face', working on perceptual decision-making tasks, while being able to interact via gaze through a micro-camera communication system; either in real time (online) or offline, i.e. 'interacting' with a

replayed recording of the other. In brief, our results demonstrate that real-time social interaction does indeed matter. Interacting humans align with each other more than when merely reacting to others as observers, across multiple levels of description, from interpersonal gaze behavior and decision making to individual metacognition. These findings, we argue, open up new avenues on how to go about not only conceptualizing and operationalizing human behavior and cognition beyond the individual, but also psychopathology and psychiatric disorders, here thought of as interpersonal misattunement and disorders of social interaction respectively.

ID: 181

Tuning gaze cueing via socio-contextual factors

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Gaze cueing consists of attention shifts towards the location cued by the averted-gaze faces. This effect does not meet the criteria for strong automaticity because its magnitude is sensitive to the manipulation of different social features. Recent theoretical perspectives suggest that social modulations of gaze cueing could also critically depend on contextual factors. We tested this idea relying on previous evidence showing that Chinese participants are more sensitive to the gaze belonging to White than to Asian faces, likely because of differences in perceived social status. We replicated this effect when social characteristics were made prominent by presenting faces belonging to different ethnicities in the same block. On the contrary, when faces belonging to different ethnicities were presented in separate blocks, a similar gaze cue emerged, likely because no social comparison processes were activated. The findings are consistent with the idea that social modulations are influenced by contextual factors.

INTEROCEPTION
Room: TC.5.05 Hörsaal

ID: 178

Cardiac sympathetic-vagal activity initiates a functional brain-body response to emotional arousal

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A century-long debate on bodily states and emotions persists. While the involvement of bodily activity in emotion physiology is widely recognized, the specificity and causal role of such activity related to brain dynamics has not yet been demonstrated. We hypothesize that the peripheral neural control on cardiovascular activity prompts and sustains brain dynamics during an emotional experience, so these afferent inputs are processed by the brain by triggering a concurrent efferent information transfer to the body. To this end, we investigated the functional brain-heart interplay under emotion elicitation in publicly available data from 62 healthy subjects using a computational model based on synthetic data generation of EEG and ECG signals. Our findings show that sympathovagal activity plays a leading and causal role in initiating the emotional response, in which ascending modulations from vagal activity precede neural dynamics and correlate to the reported level of arousal. The subsequent dynamic interplay observed between the central and autonomic nervous systems sustains the processing of emotional arousal. These findings should be particularly revealing for the psychophysiology and neuroscience of emotions.

ID: 304

Heart's role in visual and auditory duration perception, modulated by emotional content

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The experience of time is highly subjective. When we stare at the hands of a clock, a minute can feel much longer than when we are swept in a fun activity. Salient changes in external milieu (e.g., fluctuations in the visual scene) as well as in motor and internal states (e.g., speed of body movement and arousal) have all been postulated to influence duration perception. Here, we focus on the role of cardiac signals that provide a continuous background to all information processing. Because investigating durations that encompass multiple heartbeats (> 1s) can be

confounded by participants counting, we present visual and auditory stimuli of shorter durations (< 400ms) to distinct phases of the heart cycle (systole or diastole). If the heart plays a role in time perception, cardiac signalling should influence perceived durations. Indeed, data from our first experiment (N = 28) suggest that visual and auditory stimuli were perceptually shorter when presented at the systole relative to the diastole. In our second experiment, we modulated the emotional content of the presented visual stimuli (happy or angry facial expressions). Because systolic cardiac phase reflects a brief state of heightened cardiovascular arousal, we expect cardiac modulations to be greater when judging the durations of angry facial expressions. Overall, these results extend the role of cardiac signalling to temporal exteroceptive processing and provide a mechanistic basis for the observation that "time expands, then contracts, all in tune with the stirring of the heart" (in Kafka on the Shore).

Respiratory phase-dependent heartbeat evoked potential modulations are associated to cardiac, but not respiratory interoceptive attention

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Respiration and heartbeat continuously interact within the body in many different ways. We recently found higher Heartbeat Evoked Potential, indicating increased cortical processing of heartbeats, during exhalation compared to inhalation (ΔHEP) at rest. In addition, ΔHEP was higher while performing the interoceptive condition of the Heartbeat Detection task, compared to the exteroceptive condition. Furthermore, respiratory phase-dependent HEP modulations were associated to interoceptive accuracy, suggesting a role of ΔHEP in interoceptive optimization across the respiratory cycle. These findings raise the question as to whether the observed effects are specific for cardiac interoception. We herein addressed this issue by measuring HEP in 25 healthy volunteers during the execution of the Heartbeat Counting Task (HCT) and the Breath Counting Task (BCT). A cardiac and a respiratory Tone Counting Task were used as exteroceptive control conditions. We calculated ΔHEP by first computing HEP levels separately for heartbeats occurred during the inhalation and the exhalation phase of respiration, and then by subtracting the mean HEP value during inhalation from that of exhalation. Results showed non-specific HEP amplitude increases during the interoceptive conditions of both the HCT and the BCT, compared to their respective exteroceptive control conditions. However, ΔHEP specifically increased during the performance of the interoceptive condition of the HCT, compared to the interoceptive condition of the BCT. Overall, the present results indicate that the ΔHEP index could represent a physiological signature of heartbeats' cortical processing optimization across the respiratory cycle, which is specifically related to cardiac interoceptive attention.

The perception of interoceptive signals in blind individuals

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Blindness can be studied as a model system to investigate the role of sensory experience for the development, maintenance, and plasticity of central sensory representations. This assumption is based on strong empirical evidence: it has been repeatedly shown that visual deprivation is associated with massive cross-modal plasticity. Here, we examined the influence of blindness on two interoceptive submodalities that are important for bodily awareness: cardiac interoception and affective touch. We tested 36 blind individuals and 36 age and sex-matched sighted volunteers. In experiment 1, we assessed their cardiac interoceptive abilities using the heartbeat counting task. In experiment 2, we measured sensitivity to skin-mediated interoceptive signals by asking about the pleasantness of touch delivered in a CT-optimal versus a CT-non-optimal manner. We found that blind individuals perform significantly better than sighted in the task measuring their cardiac interoceptive accuracy. We did not find any significant differences in subjective dimensions of cardiac interoception, as well as purely physiological measurements (e.g., heart rate). In the case of affective touch, we found that blind individuals rate the touch as significantly more pleasant on the palm as compared with the forearm. To the best of our knowledge, our experiments are the first investigation of cardiac interoceptive abilities and affective touch sensitivity in the blind. Our results provide an important insight into building blocks of bodily awareness in the absence of vision, given the relevance of interoceptive signals in maintaining a coherent and stable sense of bodily self.

Towards new measures of thermal interoception: estimating changes in peripheral body temperature

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Thermal body signals provide crucial information about the state of an organism, and changes in body temperature have been linked to affective states (e.g., stress, pain, sexual arousal) and social scenarios (e.g., social contact, social ostracism, and dishonest behavior). The present study aimed at developing a new task measuring awareness of changes in peripheral body temperature (i.e., thermal interoception) and compared it to the classical heartbeat counting task (cardiac interoception). In 15 trials, with an infrared lightbulb we delivered stimuli of different temperature intensities to the hand of 31 healthy participants. After each trial, participants answered how much they felt their hand temperature changed from before to after the stimulation, using a visuo-analogue scale, VAS (ranging from "not at all" to "very much"). The difference between the perceived (VAS score) and actual temperature change (measured using a thermal camera) was used as a measure of thermal interoception. Performance in the task showed good inter-individual variability, differentiating between people with stronger or weaker performance. Thermal interoception did not correlate with (and was generally higher than) cardiac interoception, in line with evidence that interoception is composed of separate sub-modalities (e.g., cardiac, and thermal). This task can contribute to literature investigating the role of interoception in cognition and behavior, particularly for social and emotional contexts where temperature changes have been observed.

LANGUAGE, MEMORY AND NAVIGATION
Room: TC.5.13 Hörsaal

ID: 222

Keywords: FRN, Theta, Multilevel, Time Estimation, Feedback

Are you in the mood to learn from feedback?

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Improving performance by using feedback is characterized by large individual differences that are at least partially related to internalizing psychopathology. In this study we examined the association between depression and the behavioral and neurobiological correlates of feedback processing in healthy, undergraduate students (N=110). Participants performed a time estimation task in which they received positive (20%), negative (20%) or intermediate feedback (60%). Feedback was determined by an adaptive procedure to adjust the feedback to the participants' performance. Depression symptoms were measured using the Beck Depression Inventory (BDI-II). We used a multilevel approach on single-trial outcome measures to analyze our findings. Higher depression scores were associated with larger adjustments after negative and intermediate feedback. Feedback related negativity (FRN), was strongest for both the infrequent positive and negative feedback, but was not associated with depression. FRN was hard to quantify due to overlapping, positive going waves associated with the reward value of the feedback stimulus (reward positivity, P3) and therefore we chose to additionally quantify theta power in the same time range. Like the FRN, theta power was highest after the infrequent positive and negative feedback, but was, however, negatively associated with depression for all types of feedback. In conclusion, higher levels of depression in healthy participants were associated with larger adjustments after feedback signaling the need for behavioral adjustment and a weaker brain signal after all types of feedback. Feedback processing and following adjustment behavior seem to differentially related to depression in the sub-clinical range.

ID: 169

Keywords: Language comprehension, syntax, LAN, P600, pupil dilation

Comprehension is enhanced when the speaker's pupils are larger: pupil size and gaze direction effects on spoken language comprehension.

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Gaze direction and pupil dilation have a critical influence on communication and social interaction due to their ability to redirect and capture our attention, and their relevance to emotional information. The present study aims to explore whether pupil size and gaze direction affect syntactic processing. Participants listened to sentences that could be correct or contain a syntactic anomaly while the static face of the speaker was manipulated in terms of gaze direction (direct vs. indirect) and pupil size (mydriasis, miosis). LAN and P600 ERP linguistic components were observed to syntactic anomalies for all conditions. However, the LAN component during mydriasis was larger than during miosis. Behavioral data supported a facilitation effect for syntactic processing since reaction times were shorter for mydriasis than for miosis. Large pupils are generally associated with care, trust, interest, and attention, which might substantiate the syntactic processing facilitation. No significant modulations of language comprehension were observed as a function of gaze direction. Altogether, the here observed pupil modulations, together with previous findings, support

an automatic but context-dependent nature of syntax. An automatic syntax processing (faster and more efficient than a controlled process), combined with permeability to other relevant sources of information for communication is probably highly adaptive for language comprehension and social interaction.

ID: 128

Entorhinal grid-like codes and time-locked network dynamics track others navigating through space

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Navigating through crowded, dynamically changing social environments requires the ability to keep track of other individuals. Grid cells in the entorhinal cortex are a central component of self-related navigation but whether they also track others' movement is unclear. Here, we propose that entorhinal grid-like codes make an essential contribution to socio-spatial navigation. Sixty human participants underwent functional magnetic resonance imaging (fMRI) while observing and re-tracing different paths of a demonstrator that navigated a virtual reality environment. Results revealed that grid-like codes in the entorhinal cortex tracked the other individual navigating through space. Further, the activity of grid-like codes was time-locked to increases in co-activation and entorhinal-cortical connectivity that included the striatum, the hippocampus, parahippocampal and right posterior parietal cortices, altogether modulated by accuracy when subsequently re-tracing the paths. This suggests that network dynamics time-locked to entorhinal grid-cell-related activity might serve to distribute information about the 'socio-spatial map' throughout the brain.

ID: 207

If it ain't coupling, it ain't clicking: impaired social working memory due to disrupted fronto-parietal coupling of brain oscillations in individuals with high autistic traits

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Recently, we showed that frontal-theta-phase-to-posterior-gamma-amplitude coupling (PAC) was modulated by load in visual working memory tasks, reflecting engagement and dis-engagement of a fronto-parietal network. We used PAC as a signature of neural coordination to investigate if different working memory types were comparably implemented in the brain, especially in the social domain.

We recorded EEG from 100 non-clinical participants with low or high autistic-traits performing a social, visual and verbal working memory task, each in easy and difficult load conditions.

High autistic-traits participants showed decreased performance in the social and increased performance in the other tasks compared to low autistic-traits participants.

Frontal midline theta amplitude and coherence between the dorsomedial (DMPFC) and the dorsolateral (DLPFC) prefrontal cortex were higher in difficult than easy load conditions in all tasks.

As for PAC, a load-dependent modulation was displayed in the DLPFC during the verbal and in the DMPFC during the social and visual task. In the social and visual task for low autistic-traits participants, posterior high frequency bursts were locked close to the trough of the frontal theta cycle, indicating efficient coupling of fronto-parietal networks as in previous research.

Similarly, high autistic-traits individuals displayed the same pattern in the visual task. However, they showed a selective impairment in PAC in the social task indicating that they failed to efficiently recruit a mentalizing and working memory network.

Moreover, circular-linear correlations between preferred frontal theta phase and autistic traits suggest that this mechanism seems indeed behaviorally relevant for a better understanding of autism spectrum disorder.

ID: 230

The role of beta oscillations in the mental time travel

Mariano D'Angelo[1,2], Franscesca Frassinetti[2], Marinella Cappelletti[3]
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The brain is a time machine that processes short interval timing but also allows projecting the self in the past and in the future, i.e., to mentally time travel (MTT). Beta oscillations index temporal timing of milliseconds, i.e., higher power is associated to longer durations. Here, we clarify to what extent MTT, which spans across years, relies on parietal beta oscillations, like short interval timing, and to test the link between MTT and short intervals timing. To this aim, 30 participants performed a novel MTT task while they received transcranial Alternating Current Stimulation (tACS) over

the bilateral parietal cortex to test the role of target beta and control alpha oscillations, in addition to a non-stimulation control condition. Participants see faces of different ages. Each face was presented with a short phrase describing a life event, commonly happening in middle age. Participants were required to perform a 2-alternative forced choice task: in the 'Past condition', they indicated if it is likely or unlikely that the person has lived the life event 10 years ago; in 'Future condition' that the person will live the event in 10 years. Only beta-tACS corresponded to an underestimation of temporal distances during past, but not future, MTT. Furthermore, participants who overestimated seconds-long intervals overestimated also temporal distances in the past MTT and displayed a stronger effect of beta-tACS. These results indicate that beta oscillations constitute a common computational mechanism for both seconds-long intervals and longer temporal distances involved in the past MTT.

STRESS
Room: TC.5.15 Hörsaal

ID: 280

Distal stress and the persistence of conditioned fear memories

Marta Andreatta[1,2], Christopher Klinke[2], Matthias Wieser[1], Maren Lange[3]
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Stress influences both memory consolidation and retrieval processes. Impaired extinction of conditioned fear (i.e., persistent fear responses) has been demonstrated in individuals, who were stressed day(s) prior the learning. It remains to clarify whether such stress-induced impairment of fear extinction has long-lasting effects. We tested fear and extinction memories in 74 participants, who underwent either the socially evaluated cold pressure test (SECPT) or a sham protocol on Day1. Subsequently, all participants underwent a fear acquisition (Day2), fear extinction (Day3), and memory recall test (Day17). The unconditioned stimulus (US) was an electric stimulation, which was delivered during fear acquisition only at the offset on one shape (CS+) but not at the offset of the other shape (CS-). Successful fear acquisition was indicated by higher fear and US-expectancy ratings as well as startle potentiation to CS+ vs. CS-. Conditioned fear responses successfully decreased during fear extinction with exception of persistent stronger subjective fear in the stress group for CS+ as compared to CS-. Two weeks later during the memory recall test, explicit extinction memories weakened in all participants as indicated by the higher fear and US-expectancy ratings for CS+ compared to CS-. While implicit extinction memory weakened only in stressed participants as showed by their startle potentiation to CS+ as compared to CS-. In sum, stress may strengthen fear memories, thereby impairing fear extinction and facilitating the spontaneous recovery of conditioned fear.

ID: 357

Stress recovery with social support: A dyadic stress and support task

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How does social support bolster resilience? We have developed a new dyadic paradigm to study causal mechanisms of acute and ecologically valid social support in the laboratory. The Dyadic Stress and Support Task (DSST) consists of a psychosocial stress phase and a recovery phase. During DSST_stress, a pair of participants take turns to perform public speaking and mental arithmetic in front of a panel. Unable to see or touch each other, they witness each other's performance and feedback. During DSST_recovery, the pair either interact freely with each other for 5 minutes (Social support condition) or interact separately with an experimenter (Non-support condition). To establish the validity of the DSST, we tested 21 pairs of long-term close friends in a pilot study. Primary outcome measures were ratings of affective state and bodily arousal (VAS scales 0-100). Secondary outcome measures were heart rate and salivary cortisol. DSST_stress successfully induced subjective Stress Activation, increased Negative Affect, heart rate and salivary cortisol and decreased Positive Affect. After DSST recovery, Stress Activation and Negative Affect ratings were reduced in both groups. Positive Affect was completely restored to pre-stress baseline levels in the Social support group, while remaining significantly lower in the Non-support group.The DSST successfully induced stress and negative affect and captured stress recovery in both groups. Free-form interaction with the friend enhanced recovery of affective state, supporting the validity of spontaneous interaction between friends in experimental studies of social support. We are currently investigating the role of endogenous opioids in socially mediated stress recovery.

ID: 256

The Effect of Stress on intuitive (Dis)Honesty

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Accumulating evidence suggests that acute stress influences social decision-making, through a combination of impaired cognitive control and enhanced intuitive response tendencies. In a recent fMRI study, we found that cognitive control is not needed to be honest or dishonest per se, but that it depends on an individual's moral default: cognitive control helped dishonest participants to be honest, whereas it promoted cheating for honest participants. Therefore, it can be hypothesized that stress would have a differential effect on moral decision making depending on a person's moral default.

We combined our novel Spot-The-Difference Task (STDT), which allows for inconspicuously measuring spontaneous and voluntary cheating, with the Maastricht Acute Stress Test (MAST). Participants completed the first half of the STDT followed by the MAST (low or high stress condition) and then finished with the second half of the STDT.

We found a significant interaction between blocks (before vs after stress) and an individual tendency to cheat in the stress condition as compared to the control condition. Cheaters cheated even more after stress whereas honest participants became more honest. This suggests that in the second block participants indeed seem to rely more on their intuition after stress which amplifies their inclination to cheat or be honest, confirming our hypothesis that stress would reduce cognitive control and thereby increase the tendency to behave according to one's moral default.

ID: 359

Keywords: intrusive thoughts, acute stress, EEG, MEG

Forget about it: The influence of stress on the ability to control intrusive thoughts

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Intrusive thoughts can prevent us from letting go of what we would rather forget. Intentional memory control, can lead to subsequent forgetting of these thoughts. Intentional control relies on the function of the executive control network, which is found to be impaired after exposure to acute stress. The current talk will discuss several experiments investigating the extent to which acute stress affects the capacity to intentionally control intrusive thoughts and its underlying neural correlates using EEG and MEG. Behavioural results and frequency analyses will be presented. These findings provide the groundwork for understanding the effects of stress on memory control and the neural mechanisms that underlie intrusive thoughts.

Wednesday 20.07.2022
Symposia Slot III: 18:30 to 20:00 h

ID: 110
Room: TC.5.01 Hörsaal

Symposium
Keywords: Amygdala, Emotion, Social Cognition, Reward, Learning

The amygdala's role in affective and social learning

Chair(s): Ronald Sladky (University of Vienna, Austria), Wulf Haubensak (Medical University of Vienna)

Unequivocally, the amygdala is one of the most famous brain regions. Popular science and the persuasiveness of simple narratives has led to the simplified notion that the amygdala is the *brain center of emotions*. Of course, careful researchers are well aware that emotions are more complex and the amygdala is not one uniform center. Instead, the amygdala consists of several subnuclei with marked differences in histology, neural mechanisms, connectivity, and function. Unsurprisingly, investigating the amygdala entails a number of serious methodological and theoretical challenges. To understand the amygdala's crucial role in a wide range of phenomena studied by social, cognitive, and affective neuroscience is certainly an endeavor that calls for multidisciplinary collaborations and joint conceptual frameworks.

In this symposium we will discuss recent progress in amygdala research. We address this topic from a translational perspective by presenting evidence from rodent and human neuroscience using a wide range of research methods and experiments. We reject the simplistic concept that the amygdala is nothing but a simple embodiment of a stimulus-response system. Instead, we argue that the amygdala plays a central role in the encoding and learning of affective value to guide future behavior in conjunction with other cortical and subcortical brain areas. This makes the amygdala indispensable for many aspects of emotion processing and social cognition. Impaired functioning, on the

other hand, can give rise to often undesired behavioral and experiential consequences and symptoms of psychiatric illnesses.

The amygdala's role in conditioned fear – Methodological challenges and solutions for translational research

Karita Ojala[1], Dominik Bach[2]
[1]University Medical Center Hamburg-Eppendorf and University of Zurich, [2]University College London and University of Zurich

The amygdala has emerged as a central brain region for associative learning from threat based on decades of rodent studies using well-established fear conditioning paradigms. While it is simplistic to reduce associative fear to the amygdala, specific nuclei of the amygdala are necessary for the acquisition and expression of conditioned fear in rodents. On the other hand, human neuroimaging studies have not been able to find unambiguous conditioned responding in the amygdala, and the few existing studies on amygdala lesion patients showing impairment in conditioned fear responses are methodologically limited. Therefore, it is not clear to what extent the amygdala is involved in conditioned fear in humans compared to animal models. I will discuss various methodological challenges in translating behavioral and neural findings on fear conditioning across species and suggestions for bridging the gap, based on an extensive review of the literature as well as experimental studies.

The body's guide to affective decisions

Dominic Kargl, Wulf Haubensak
Medical University of Vienna

Affective responses require assigning value to environmental predictors of threat or reward. However, the affective value of novel predictors is inherently uncertain. To resolve uncertainty, brains are thought to form abstracted representations of their environment, linking sensory stimuli with bodily states. Yet, the circuit interactions and mechanisms mediating this process are largely unknown. Using fMRI and electrophysiology in mice, we mapped a cortico-limbic circuit between the insula and amygdala, integrating bodily states into CS value. Uncertainty on CS value in the amygdala recruited these CS representations in the insula bottom-up. In this way, the amygdala incorporated interoceptive feedback from the insula to facilitate future affective responses to the CS. We provide a potential circuit module for affective learning under states of uncertainty. That is, linking the environment with our bodily states to support affective decisions. Dysfunctions in the insula-amygdala network may therefore underlie intolerance to uncertainty, observed in psychiatric conditions.

Unravelling the different roles of the basolateral and central amygdala in human trust learning

Lisa Rosenberger[1], Ronald Sladky[1], Federica Riva[1], Claus Lamm[1], Jack van Honk[2]
[1]University of Vienna, Austria, [2]University of Cape Town, South Africa

Learning who can be trusted and adaptively responding to that knowledge is crucial to our economic and social wellbeing. I present a study where we showed substantial impairments in trust learning in humans with selective bilateral damage to the basolateral amygdala (BLA). Crucially, BLA-damaged subjects, unlike control subjects, completely failed to adapt their investments when interacting with a trustworthy and an untrustworthy partner. Accordingly, the human BLA is fundamental to learning from social experience. In a follow-up fMRI study with healthy subjects, we further specified the basolateral, as well as central amygdala's role during trust learning. While the central amygdala was active during trust behaviour planning, the basolateral amygdala was specifically active during the evaluation of the interaction's outcome. Together, these two studies highlight the importance of a subregion approach to understanding the role of the amygdala in social experiential learning.

Social stimulus-responsive neurons in the mouse basal amygdala-nucleus accumbens pathway

Christopher Pryce
University of Zurich

Many basal amygdala (BA) glutamate neurons project to nucleus accumbens (NAc). Whether they respond to reward, aversion, or both, remains unclear, including regarding social stimuli. After retrograde labelling of BA-NAc neurons, male mice were exposed to either social reward or social aversion. A relatively high number of medial BA-NAc neurons expressed c-Fos after reward or aversion, and a relatively high number of posterior BA-NAc neurons exclusively after aversion. Medial and posterior BA-NAc neurons differed in their transcriptomes, including genes in glutamate, GABA, cholecystokinin, and dopamine pathways. Calcium-related fibre-photometry in medial BA-NAc neurons revealed similar activity during reward and aversion interactions; neuronal activity was greater during social than non-social periods. The *Fos*-dependent TRAP system showed that most "social neurons" responded to reward or aversion, and a minority to both. These findings provide insights into the BA-NAc pathway including potential pharmacological targets for reward or aversion psychopathologies.

Breakdown of utilitarian moral judgement after basolateral amygdala damage

Jack van Honk[1], David Terburg[2], Estrella R. Montoya[2], Jordan Grafman[3], Dan J. Stein[1], Barak Morgan[1]
[1]University of Cape Town, South Africa, [2]Utrecht University, The Netherlands, [3]Northwestern University

Most of us would regard killing another person as morally wrong, but when the death of one saves multiple others, it can be morally permitted. Rodent decision-making research suggests that the model-based algorithm depends on the basolateral subregion of the amygdala (BLA), but these findings have not yet been translated to human moral decision-making. Here, in five humans with selective, bilateral BLA damage, we show a breakdown of utilitarian

sacrificial moral judgments, pointing at failure of model-based moral decision-making. Across an established set of moral dilemmas, healthy controls frequently sacrifice one person to save more others, but BLA-damaged humans withhold such sacrificial judgments even at the cost of thousands of lives. Our translational research confirms a neurocomputational hypothesis drawn from rodent decision-making research by indicating that the model-based algorithm which underlies outcome-based, utilitarian moral judgments in humans critically depends on the BLA.

ID: 120
Room: TC.5.03 Hörsaal

Symposium
Keywords: moral decision-making, moral value, moral learning, violence, neural correlates

Understanding the moral compass: individual variation in moral behaviour from a behavioural neuroscientific perspective

Chair(s): Aiste Ambrase (University of Tübingen, Germany), Giuseppe Ugazio (University of Geneva)

Moral behaviour varies considerably among individuals both within the realm of appropriateness and more so when it comes to wrongful acts. While the neuroscientific inquiry into moral decision-making has identified several of the neural mechanisms processing moral choices, many questions still remain open. To address them, a shift in focus from objective to subjective experimental and observational parameters is apparent. In this symposium, we will bring together different aspects of subjective moral experience and its neural representation by means of various methodological approaches in an attempt to unveil how our experience of morality differs. In the first talk of the symposium, G. Ugazio (Geneva, CH) will present neural signatures of subjective moral value, as investigated with a novel behavioural paradigm paired with neurocomputational modelling. Then L. Lengersdorff (Vienna, AT) will present how the neural valuation system contributes to learning to avoid harm to others as opposed to oneself. In the third contribution, N. Blankenstein (Leiden, NL) will talk about predicting violent and non-violent delinquency in at-risk youth, using biological, psychological and social environmental measures. Finally, A. Ambrase (Tübingen, DE) will present meta-analytical results about neural correlates of moral decision-making on objective and subjective measurement parameter levels as well as similarities and differences between moral, risky and ambiguous decision-making. Taken together, the four presentations represent some of the latest contributions to the field of the neurobiology of morality, offering a multi-modal and interdisciplinary approach on a topic that is heavily discussed and highly apparent in our everyday lives.

Presentations of the Symposium

Neuro-computational foundations of moral preferences

Giuseppe Ugazio[1], Marcus Grueschow[2], Rafael Polania[3], Claus Lamm[4], Philippe Tobler[2], Christian Ruff[2]
[1]Zurich Center for Neuroeconomics (ZNE), Department of Economics, University of Zurich, Switzerland; Moral Psychology Research Lab, Department of Psychology, Harvard University, USA; Geneva Finance Research Institute, University of Geneva, Switzerland, [2]Zurich Center for Neuroeconomics (ZNE), Department of Economics, University of Zurich, Switzerland, [3]Decision Neuroscience Lab, Department of Health Sciences and Technology, ETH Zurich, Switzerland, [4]Social, Cognitive and Affective Neuroscience Unit, Department of Basic Psychological Research and Research Methods, University of Vienna, Austria

Many humans consider it intuitively wrong to employ the same scale to compare moral value (e.g. of a human life) with material value (e.g. of money), although it is often assumed that domain-general neural decision mechanisms employ a common 'neural currency' to value choice options in many different contexts. In this paper, we directly test if moral subjective values are represented by similar neural processes as financial subjective values. In a study combining functional magnetic resonance imaging with a novel behavioral paradigm, we identify neural representations of the subjective values of human lives or financial payoffs by means of structurally identical computational models. Correlating isomorphic model variables from both domains with brain activity reveals specific patterns of neural activity that selectively represent values in the moral (right temporo-parietal junction) or financial (ventral-medial prefrontal cortex) domain. Our findings show that human lives and money are valued in (partially) distinct neural currencies.

The neurocomputational bases of learning to avoid another person's harm

Lukas L. Lengersdorff[1], Isabella C. Wagner[1], Patricia L. Lockwood[2], Claus Lamm[1]
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Humans can adapt their behavior to avoid harm. However, it remains unclear how we learn to avoid actions that might hurt others, and if such prosocial learning differs from learning for oneself on the neural level. In this fMRI study, 96 male participants learned to avoid painful stimuli either for themselves or for another individual. We found that participants made more optimal choices when learning for the other person. Computationally, this was reflected in prosocial choices being more consistently based on the information learned about the stimuli. Higher choice consistency was also associated with increased activation in the ventromedial prefrontal cortex, which further exhibited functional connectivity with the right temporoparietal junction. Our results imply that prosocial learning arises from an interplay of the neural valuation network and structures involved in social cognition. They also suggest that prosociality may exceed self-serving tendencies when another person's physical integrity is at stake.

Who is at risk? Using the biopsychosocial model to study delinquency in adolescents

<u>Neeltje E. Blankenstein</u>[1], Samantha Bouwmeester[2], Sterre van Haeringen[3], Rowan T. van Klink[3], Lieke van der Meule[3], Lucres M.C. Jansen[3]

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The biopsychosocial model states that adolescent antisocial behavior, such as (non-)violent delinquency is the result of an interaction between biological (e.g. testosterone, heart rate), psychological (e.g. psychopathic traits, empathy) and social-environmental factors (e.g. trauma, SES). We applied this model using latent-class regression analyses to predict non-violent and violent delinquency in youth (N=871, 82% male, M=17.67 years old, range 9-27 years). We formed biological classes of youth, incorporating psychological factors, to predict non-violent and violent delinquency from these classes moderated by social-environmental factors. Four classes of youth were revealed; a 'biological susceptible - high psychopathic traits', a 'low problem', a 'high problem – high psychopathic traits', and a 'biological susceptible – externalizing-reactive' class. The risk of violent and non-violent delinquency in these classes were differentially exacerbated or diminished depending on their demographics, trauma, and substance use. This study illustrates how the biopsychosocial model can explain the complexity of antisocial behavior in youth.

A coordinate-based ALE meta-analysis on neural correlates of moral, risky and ambiguous decision-making

<u>Aiste Ambrase</u>[1], Veronika Müller[2], Hong Yu Wong[3], Birgit Derntl[4]

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Moral dilemmas have been widely used to identify neural underpinnings of morality. Quite often, choosing between two conflicting options results in decision uncertainty. In this coordinate-based ALE meta-analysis we have compared neural correlates of moral decision-making (n=77 studies) with other types of uncertain value-based decision-making: risky (n=66) and ambiguous (n=51). Comparing the three decision types allows for better distinction of domain-general decision networks (e.g., ventromedial and dorsolateral prefrontal cortex, anterior cingulate, insula) as well as specific, domain-related functional brain areas (moral: temporoparietal junction, risky: striatum). Importantly, we have conceptually separated three different levels of inquiry as determined by the contrast of interest in the experiments and investigated within each domain neural networks of 1) a general decision-making process, 2) domain-determined components, and 3) subjective choice preferences. This is the first meta-analysis to rely on this three-level-approach to compare joint vs. distinct neural correlates of different domains of decision-making.

ID: 117
Room: TC.5.05 Hörsaal

Beyond simple cost-benefit trade-offs: integrative computations that shape effort allocation

Chair(s): Dennis Hernaus (School for Mental Health and Neuroscience, Maastricht University, The Netherlands), Eliana Vassena (Donders Institute for Brain, Cognition and Behaviour, Radboud University Medical Center, Nijmegen, The Netherlands)
Discussant(s): Dennis Hernaus (School for Mental Health and Neuroscience, Maastricht University, The Netherlands), Eliana Vassena (Donders Institute for Brain, Cognition and Behaviour, Radboud University Medical Center, Nijmegen, The Netherlands)

Exerting effort often serves a purpose. For example, a cycling trip to a nearby store might serve to address a craving for your favourite meal. Decades of research in psychology and neuroscience have established that these effort-based decisions can be framed as a *cost-benefit trade-off*, where the choice to exert effort crucially depends on expected benefits (i.e., rewards) and the amount of effort required (i.e., costs). Yet, recent work implies that costs and benefits alone do not tell the whole story. Mounting behavioural, computational, and neural data suggest that, *beyond costs and benefits*, a multiplicity of variables impact whether, when, and how much effort we exert.

In this symposium, we bring together five international researchers to discuss hitherto unexplored cognitive and neural mechanisms that shape effort-based decisions. Important themes in this symposium include *learning* when it is efficient to exert effort, how this is affected by state-like variables (e.g., stress, low mood), and which neural and cognitive mechanisms underlie these computations. Moreover, we illustrate how the presence of *aversive outcomes* shape the willingness to exert effort, highlighting overlapping and separate neural mechanisms that dissociate appetitive from

aversive motivational contexts. Taken together, this overview highlights innovative theoretical and empirical evidence for how effort-based decisions are driven by complex integrative computations, beyond simplistic cost-benefit trade-offs, which has great potential to generate a richer understanding of the basis of when and how we choose to exert effort.

Presentations of the Symposium

How the marginal value of effort shapes efficient effort allocation decisions

Ross A Otto
Department of Psychology, McGill University, Canada

Our ability to perform tasks is constrained by our limited mental resources, which mandates that people should minimize cognitively "effortful" processes when possible. Recent theories prescribe that decisions to expend (or withhold) effort are governed by a cost-benefit trade-off. Yet, increasing effort investment may also confer larger or smaller performance benefits—i.e., the marginal value of effort—depending on the situation. On this view, we hypothesize that the magnitude of reward-induced effort modulations should depend critically on the marginal value of effort for the given context, and furthermore, the marginal value of effort should be learned over time as a function of direct experience in this context. Employing a computational model and two well-characterized cognitive control tasks, we demonstrate that individuals appear to learn the marginal value of effort for different contexts. Together, these results enrich theories of cost-benefit effort decision-making by highlighting the importance of the (learned) marginal utility of cognitive effort.

Modeling motivation as a meta-learning problem: the integration of effort, reward and stress

Eliana Vassena
Donders Institute for Brain, Cognition and Behaviour, Radboud University Medical Center, Nijmegen, The Netherlands

How do we decide to put effort in what we do? Recent theoretical frameworks suggest that we integrate diverse sources of information at hand to select which goals are worth our investment. We propose meta-learning as the key mechanism underlying this integration: we learn which actions are worth our while, based on the potential reward, discounted by the inherent costs. In a series of simulations and experiments, we show that our neuro-computational meta-learning framework accounts for decisions involving effort, reward, risk, under stress and in stress-related disorders. We propose a plausible neurobiological implementation for these mechanisms: the cortico-subcortical loops between medial prefrontal cortex and dopaminergic and noradrenergic nuclei. This account bridges evidence from psychological theories of motivation with neuroscience of decision-making under a single explanatory framework.

Reward and aversive motivation influence distinct effort strategies for cognitive control allocation

Debbie M Yee
Cognitive, Linguistic, and Psychological Sciences, Brown University, Providence, RI, USA

Humans demonstrate the impressive ability to allocate effort on tasks based on the rewards they would obtain (e.g., bonus earned), as well as the penalties they would avoid (e.g., job termination). Despite the intuition that both reward and punishment shape adaptive (cognitive) control, it remains unclear whether and how cognitive strategies involving effort allocation differ between incentive types. We combine experimentation, computational modeling, and fMRI to disentangle the influences of reward and penalty on control allocation. Participants performed a novel incentivized control task where they earned or lost money for correct and incorrect responses, respectively. Using the Expected Value of Control model and fMRI, we show how dissociable neural circuits underlie multivariate control adjustments for how reward promotes greater attentional control versus how penalty promotes greater response caution. These data reveal how inclusion of reward and aversive incentives provide novel insights into the multi-faceted interactions between motivation and cognitive control.

The impact of acute stress on appetitive versus aversive motivation

Dennis Hernaus
Maastricht University

Stressful situations trigger a fight-or-flight response, an intricate psychophysiological process that is essential for survival. Central to this response is the rapid release of energy (i.e., glucose), which can be used to attain desired goal states (e.g., safety). However, the psychological mechanisms that control energy expenditure/effort allocation under stress have received little attention. We investigated how experimental stress induction altered the willingness to exert physical effort (here, grip force) in exchange for desirable outcomes. Inducing acute stress did not impact *appetitive* motivation; stress versus unstressed participants were equally willing to exert grip force to obtain monetary rewards (Study 1; n=40 per condition). In a follow-up study, however, we observed preliminary evidence that acute stress increased willingness to exert grip force to avoid painful electric stimulation, a proxy measure of *aversive* motivation (Study 2, currently ongoing). These results highlight how acute stress may alter cost-benefit computations involving aversive outcomes, thereby promoting survival.

A tale of two efforts in reinforcement learning

Sara Garofalo[1], Francesca Starita[1], Gianluca Finotti[2], Giuseppe di Pellegrino[1]
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Rewards and punishments can directly influence how we learn and select actions by determining the value of a given choice. However, a more indirect source of behavioural control can be exerted by Pavlovian cues that predict

such rewards/punishment and, as such, modulate the direction and effort of our actions. Although from a utility maximization perspective, effort should always be minimized, instrumental actions can be invigorated by environmental stimuli if they signal appetitive or aversive consequences (i.e., Pavlovian cues), even when task-irrelevant. Based on data from healthy individuals engaged in cue-guided decision-making, we will show a progression of behavioral and neural evidence pointing to a dissociation between two types of invigoration (i.e., effort), related to separate underlying mechanisms, respectively associated with a more specific or a more generalized form of motivation to work for reinforcers signaled by external Pavlovian cues. Adaptive and maladaptive implications will be discussed.

ID: 133
Room: TC.5.13 Hörsaal

Symposium
Keywords: Self-generated touch, affective touch, tool-mediated touch, illusory touch, tactile spatial perspective taking

Context-dependent touch: how the brain interprets the body and world to guide behavior

Chair(s): Konstantina Kilteni (Karolinska Institute, Sweden), Luke E. Miller (Donders Institute, Nijmegen, The Netherlands)

Discussant(s): Konstantina Kilteni (Karolinska Institute, Sweden), Luke E. Miller (Donders Institute for Brain, Cognition and Behaviour, Netherlands), Rochelle Ackerley (Laboratoire de neurosciences cognitives, CNRS – Aix-Marseille University, Marseille, France), Xaver Fuchs (University of Salzburg, Salzburg, Austria), Xavier Job (Karolinska Institute, Sweden)

The skin is the largest organ of the body. Since our birth, touch continuously provides crucial information about our self, the others, the world around us, and the relationships between them. A plethora of experimental and neural evidence suggests that the brain can extract a great variety of information from tactile input and use it to guide behavior. For example, we can understand which touches were generated by our movements and which were not, we can infer the emotional and affective component of touches produced by the others, and we can sense the world with tools as if they were a sensory extension of our body. At the same time, the brain can extract information even in the absence of physical touch. For example, we might mislocalize touch to non-stimulated limbs. This symposium will present experimental works that attempt to understand the underlying psychological and neural processes during extracting information from touch in different contexts. We bring together studies in the context of self-generated touch (Konstantina Kilteni), social touch (Rochelle Ackerley), tool-mediated touch (Luke Miller), illusory touch (Xaver Fuchs) and touch in the context of spatial perspective-taking (Xavier Job). Each talk is concerned with different contexts of touch and all speakers will devote a part of their talk to their current ideas about how the brain extracts information from our tactile sensory input.

Presentations of the Symposium

The influence of tactile information in guiding behavior in the context of self

Konstantina Kilteni
Karolinska Institute, Sweden

Distinguishing the sensations that are produced by our movements from those produced by external causes is a fundamental problem for our nervous system and a prerequisite for our survival. Compare how dramatically different our responses are to the footsteps we hear, when these are not due to our walking but due to a stranger following us, or to the touch we feel on our cheek, when this is not due to our hand but due to an insect crawling on our face. To solve this problem and guide our behavior appropriately, the nervous system uses information about our own movements to predict and attenuate the reafferent sensory signals. This predictive attenuation of self-generated touch (a) depends on an internal model between the action and its temporally precise feedback, (b) yields reduced somatosensory responses and increased corticocerebellar connectivity, and (c) it is reduced in non-clinical individuals with high schizotypy personality traits.

The influence of tactile information in guiding behavior in the context of tool use

Luke E. Miller
Donders Institute, Nijmegen, The Netherlands

Intuitively, the human sense of touch is body-centric; that is, it is concerned with the detection and localization of objects contacting the body surface. However, the nervous system is also often challenged with the task of interpreting tactile signals that arrive in contexts where touch occurs outside the body, such as during tool use—a blind person navigating with a cane is a prime example of this. We find that even sighted humans are extremely good at interpreting touch signals that arise during tool use, and can almost perfectly localize where an object contacts a tool. To do so, the brain re-uses neurocomputational processes that are originally for localizing touch on the body to now localize touch on a tool. This suggests that a tool is an integrated part of the somatosensory system when wielded to guide sensing behavior, as if it were an extended somatosensory organ.

The influence of tactile information in guiding behavior in an affective context

Rochelle Ackerley

Laboratoire de neurosciences cognitives, CNRS – Aix-Marseille University, Marseille, France

We explore and interact with our world through touch. This tactile input is not purely sensory, but has a large affective and emotional component. The sensory, discriminative component is relayed by fast-conducting afferents, whereas the affective part if hypothesized to be relayed more by slowly-conducting C-fibers. In the case of social touch, this implies the activation of C-tactile (CT) afferents. CT afferents are thought to optimally convey pleasant touch, such as a hug or a stroke over the skin, especially through skin-to-skin contact. The information from CT afferents does not seem to guide our direct, instant behavior from moment-to-moment, rather is appears to be important in the reinforcement and learning of gentle touch perception. This is especially so in the case of strengthening social bonds and in affiliative touch. Thus, affective touch information is essential to influence how we interpret situations and it influences how we react.

The influence of tactile information in guiding behavior in the context of illusory motion

Xaver Fuchs

University of Salzburg, Salzburg, Austria

Humans can easily be fooled about where and when they are being touched. Tactile illusions can arise when the brain interprets unexpected touch sequences within a context of motion. In natural situations, objects moving across the skin often create correlated touch at natural speeds. To efficiently guide behavior, the brain tunes to these regularities and overrides unexpected sensory input with its internal expectations. For example, when motion is unexpectedly fast, distances appear compressed and time appears dilated. We presented participants fast touch sequences, either within or across limbs. Participants perceived stimuli in illusory locations and often even assigned them to the wrong limb. We also observed dilation of perceived time. In line with a Bayesian account to perception, we propose that the brain illusorily "corrects" stimulus position, elapsed time, and even limb assignment to better fit with its internal expectations about touch in a context of motion in external space.

The influence of tactile information in guiding behavior in the context of spatial perspective taking

Xavier Job

Karolinska Institute, Sweden

Tactile information can be represented differently depending on the spatial perspective that is adopted, either from an ego-centered perspective (e.g. from the location of one's body), or a decentered perspective (e.g. from another's perspective). This talk will focus on tactile letter recognition paradigms demonstrating that individuals differ in the perspective spontaneously adopted when interpreting ambiguous tactile stimuli. Additionally, switching between preferred and non-preferred perspectives incurs a behavioral cost, indexing the flexibility of tactile perspective-taking. We show that tactile perspective-taking is affected by visual experience, such that a decentered perspective is adopted significantly less by blind individuals. Furthermore, those with little visual experience (early-blind) demonstrate a greater cost of switching between perspectives. The findings suggest that spontaneous and flexible perspective-taking differ across individuals and are partly shaped by visual experience. Current ideas about how tactile information can be represented and interpreted from multiple spatial perspectives to guide behavior will be discussed.

ID: 140
Room: TC.5.15 Hörsaal

Symposium
Keywords: Ecological validity, mobile methodology, EEG, eyetracking, naturalistic behaviour

The World is your Lab - The Opportunities and Challenges of Real-World Data Collection

Chair(s): Cesco Willemse (Social Cognition in Human-Robot Interaction, Istituto Italiano di Tecnologia, Italy), Magda Mustile (Psychology, Faculty of Natural Sciences, University of Stirling, UK; Social Cognition in Human-Robot Interaction, Istituto Italiano di Tecnologia, Italy), Agnieszka Wykowska (Social Cognition in Human-Robot Interaction, Istituto Italiano di Tecnologia, Italy)

The term ecological validity, in the context of the 'real-world or the lab'-dilemma, is often used as a trope to discuss strictly-controlled and specific laboratory data in terms of generalisability to the complex mechanisms involved in cognition. The generalisability aspect is still under question, as it is not necessarily the case that studies in the lab match observations outside of it. One way to address this criticism fundamentally, is utilising modern technological advances in real-world . However, this approach puts additional strain on researcher decisions, such as compromises in experimental control as well as having to organise and process large amounts of complex data. This symposium seeks to highlight the opportunities of data collection 'in-the-wild' with novel techniques, but also serves as a forum to discuss the complexities of them. We invited speakers who crossed the boundaries of traditional screen-based experiments to present their experience in interactive, mobile, and real-world methods. Examples of these techniques include mobile EEG and hyperscanning, eyetracking of dynamic behaviour, wearables, computer vision, and interactive protocols with robots. Furthermore, the observation and interpretation of natural behaviour is discussed, as opposed to behaviour restricted by lab tasks. Rather than purely presenting ground-breaking data, the presentations revolve

around sharing considerations in design, methodologies such as programming and multi-method synchronisation, the processing of noisy and complex data, and the interpretation thereof. Real-world data collection is challenging, but it is through sharing practical experiences that we can seize its opportunities as an approach to understand naturalistic interactions where they occur.

Presentations of the Symposium

Improving ecological validity in social cognition research

<u>Kyveli Kompatsiari</u>, Abdulaziz Abubshait, Agnieszka Wykowska
Social Cognition in Human-Robot Interaction, Istituto Italiano di Tecnologia, Italy

In this presentation, we will discuss recent techniques allowing for higher ecological validity in cognitive sciences together with their potential limitations and challenges. To begin with, including humans as interactive partners in experimental protocols could be crucial for understanding intra- and interpersonal processes during participation in real-time reciprocal interactions. However, using humans as partners might pose several limitations in measuring intrapersonal processes, while measuring interpersonal and interbrain processes is limited to very controlled experiments up to date. Another type of interactive partners that could offer a unique opportunity for an increased ecological validity are embodied humanoid robots due to their social presence and the possibility for interactive paradigms. However, employing neuroscience methods and eye tracking methodologies in these protocols should be carefully revisited in terms of design and analysis to allow for a high level of experimental control.

Challenges Related to the Identification and Extraction of Neural Markers of Cognitive Processes Underlying Real-World Behaviour

<u>Simon Ladouce</u>
Institut Supérieur de l'Aéronautique et de l'Espace (ISAE), France

Our experience of real-world environments is continuous, ever-changing and dynamic. Capturing cognitive events as they occur during naturalistic behaviours is an exciting research avenue to unravel embodied aspects of human cognition. This prospect faces several technical and conceptual hurdles. A critical issue concerns identifying cognitive events and their extraction from brain imaging data acquired during real-world behaviour. These challenges and potential solutions will be illustrated by a visual search experiment that took place in a library. The participants searched for book covers while their brain activity and eye movements were recorded using electroencephalography (EEG) and Eye-Tracking. The extraction of EEG signals related to experimental events (Event-Related Potentials) from continuous recordings acquired in a naturalistic setting poses several issues. The results demonstrate the relevance of multimodal recordings (ocular and brain dynamics), scalable experimental design and template-matching approaches to extract neural markers of visual attention from neural data acquired in the real-world.

Mobile EEG to Investigate Cognitive Mechanisms Underlying Locomotion in the Real-World: Feasibility and Challenges

<u>Magda Mustile</u>
Psychology, Faculty of Natural Sciences, University of Stirling, UK; Social Cognition in Human-Robot Interaction, Istituto Italiano di Tecnologia, Italy

Neuroscientific investigations employing the electroencephalogram (EEG) provided relevant insights on neural markers of cognitive mechanisms underlying human behaviour. However, EEG experiments traditionally are carried out using poorly informative tasks, while participants are motionless. Due to these constraints, research is still far from revealing cortical markers of complex cognitive mechanisms, particularly in relation to whole body movements. The development of portable brain imaging technologies, such as the mobile EEG, EMG or eye tracking, provides the unique opportunity to monitor brain-body dynamics in real world environments. However, the application of mobile devices, opens several problems that need to be addressed. For example, artifacts generated by free movements are more prominent in real-world experiments compared to laboratories. In this talk, I will present recent findings on neural markers of cognitive process underlying naturalistic locomotion employing the mobile EEG approach, and the challenges associated with the recording of whole-body movements in real-world settings.

Studies in social behaviour and cognition using wearables and theatre

<u>Jamie A. Ward</u>
Computing Department, Goldsmiths University of London, UK

Measuring detailed information on how people move, see, and think during realistic social situations can be a powerful method in studying social cognition. However, measurement-driven research can be limited by the available technology, with bulky equipment and rigid constraints often confining such work to the laboratory, thus limiting the ecological validity of any findings. Together with colleagues at Goldsmiths, UCL, and Keio University, I have been working on several projects that use wearable sensing to take this research out of the laboratory and into the real world -- while on the way, stopping off at the theatre. In this talk, I will give a brief overview of some of our work, and try to show how the paradigm of 'theatre as a laboratory', might provide a way forward, both for research in social cognition, and in wearable sensing.

Conversation as a Model Task for Moving Between Lab and Life

<u>Tom Foulsham</u>[1], Jessica Dawson[1], Astrid Priscilla Martinez Cedillo[2]
[1]Department of Psychology, University of Essex, UK, [2]Department of Psychology, University of York, UK

Previous research has suggested that basic behaviours linked to social cognition – such as looking at another person – are different in face-to-face situations as compared to when responding to images or video. These differences are likely to do with the potential for interaction. Mobile eyetracking and computer vision approaches enable researchers to monitor gaze in real interactions, but methodological and analytical challenges remain. We describe a set of experiments investigating gaze within, and in response to, conversations between small groups. Importantly, we find a close correspondence between gaze in the real interaction and that of people watching videos of the interaction later. This indicates that pre-recorded conversations could be used as a model task for studying social attention. Despite the lack of reciprocal gaze, participants watching a recorded conversation follow the speaker, and we can manipulate the cues available (including the actors' gaze) to study signalling in a naturalistic setting.

Thursday 21.07.2022
Symposia Slot IV: 10:00 to 11:30 h

ID: 107
Room: TC.5.01 Hörsaal

Symposium
Keywords: social isolation, loneliness, brain, hormones, adolescence

Novel Insights into the Effects of Social Isolation and Loneliness: Evidence from Laboratory and Field Experiments

Chair(s): Giorgia Silani (University of Vienna, Austria), Ana Stijovic (University of Vienna, Austria)

Social affiliation is one of the fundamental needs of social species and a potent reward that drives behavior. In humans, loneliness is defined as the distress resulting from perceived lack of social connections and it serves as an aversive signal to motivate their repair. Evolutionary theories of loneliness suggest that both positive social contacts and stable relationships are necessary to reach a satisfactory level of connectedness, especially at young age.

In this symposium, we aim to provide novel insights into the effect of social isolation and loneliness in humans, by devoting particular attention to the translation of laboratory findings to real life. Dr. Scheele will provide evidence that chronic loneliness may be rooted in a compromised integration of trust-related information. Dr. Shamay-Tsoory will present data showing that lonely individuals exhibit a reduced ability to adapt their movement to their partner's. Ms. Stijovic will discuss the effects of social isolation on physiological and psychological momentary states in the lab and daily life. Dr. Tomova will highlight the effects of social isolation on adolescent cognition and brain markers predicting sensitivity to acute isolation. Finally, Dr. Nguyen will show that time spent alone might also have regulatory benefits depending on how it is spent.

In this symposium, the effects of social isolation and loneliness will be identified with unprecedented precision on different levels: (1) physiological, including oxytocin and cortisol, (2) subjective, including mood, affect, and stress, and (3) brain imaging, where modulation of brain activity in relation to loneliness will be discussed.

Presentations of the Symposium

Neural and hormonal Mechanisms of impaired social Interactions in chronic Loneliness
<u>Dirk Scheele</u>
University of Oldenburg, Germany

Why do people stay lonely if they have the opportunity to form new, positive social relationships that may alleviate feelings of loneliness? To address this question, we used a pre-stratification strategy and recruited healthy individuals with high and low loneliness scores. During functional magnetic resonance imaging, participants completed a social gambling task and an interpersonal trust game to measure the subjective value of engaging in social situations and rapid trustworthiness decisions during initial encounters. Furthermore, we probed hormonal and affective responses to positive social interactions. Our findings suggest that unlike social anxiety, loneliness is not associated with withdrawal from social interactions. By contrast, we found evidence that lonely individuals exhibit attenuated oxytocinergic and affective responses to positive social interactions and blunted activation and functional connectivity of the anterior insula during trust decisions. Thus, a compromised integration of trust-related information as a shared neurobiological component may hamper social interactions in loneliness.

Alone again: altered Activation in the Action Execution System during Synchronization in High Loneliness Individuals
<u>Simone Shamay-Tsoory</u>
University of Haifa, Israel

Evolutionary theories suggest that loneliness evolved as a signal driving people to reconnect. Here we examine how lonely individuals engage in social interactions. We scanned low and high loneliness individuals while engaging in movement synchronization and found that lonely individuals exhibited a reduced ability to adapt their movement to

their partner's movement. Intriguingly, during movement adaptation periods, high loneliness individuals showed increased activation in the action-observation (AO) system, specifically in the inferior frontal gyrus. We propose a model according to which lonely people may require stronger activation of their AO system for alignment, to compensate for deficiency in this ability. We further examined inclusion motivation in lonely individuals. We found that lonely individuals exert more effort to be included during exclusion. These findings are in line with previous research indicating that while loneliness is associated with self-preserved mindset, when presented with social acceptance cues – they show increased social motivation.

Disrupted Social Homeostasis? Comparable Effects of Social Isolation and Fasting on Energy: Evidence from the Lab and Field

Ana Stijovic
University of Vienna

Social contact is a basic need and could be regulated by a dedicated 'social homeostatic' system. In contrast to other homeostatic systems, such as the regulation of food intake, little is known about the impact of short-term social isolation on human psychology and physiology. First, we investigated the effects of social isolation compared to the effects of fasting in a tightly controlled laboratory experiment. Next, to corroborate our findings from the lab, we conducted a field study during COVID-19 lockdown using an ecological momentary assessment approach. Across both contexts, eight hours of social isolation led to changes in energy and fatigue comparable to the effects of fasting. This suggests that lowered energy could be part of a homeostatic response to a lack of social contact. More broadly, our findings provide insight into the potential mechanisms underlying the detrimental effects of longer-term isolation.

Isolation and Loneliness in Adolescence

Livia Tomova
University of Cambridge, UK

Loneliness is increasingly affecting adolescents and emerging adults. Brain development in this age group is particularly sensitive to loneliness and has been associated with mental health problems later in life. Yet, the pathways of how loneliness impacts cognition and behaviour in adolescence are not clear. Using an experimental approach, we assessed the effects of social isolation on reward responsiveness, impulse inhibition and fear learning in late adolescence (ages 16-19) and also studied whether social media usage can remediate effects of isolation. Using ultra-high field 7T MRI scanning we assessed brain markers predicting sensitivity to isolation in the developing brain. Our data show that isolation increases reward responsiveness and fear learning while impairing impulse inhibition. Social media usage only partially remediated effects of isolation in the domain of impulse inhibition. I will discuss the implications of these findings as well as brain markers predicting sensitivity to these effects.

Exploring the Regulatory Function of Solitude

Thuy-vy Nguyen
Durham University, UK

Solitude is commonly defined as either a physical experience of being alone or subjective experience of being alone. Instead of being a negative experience like loneliness, solitude is a regular event of everyday life. Across the lifespan, the amount and frequency of spending time alone increases with age. Most adults see time spent alone as an opportunity for rest and this evidence has been demonstrated cross-nationally. However, how solitude provides such opportunity has not been well-understood. At most, previous literature presented contradicting evidence that makes it challenging to determine when solitude is restful and whether people indeed pursue it for that purpose. In this talk, I will discuss a few experimental works that might shed light on future research that can look at biological mechanisms that explain the regulatory function of solitude.

ID: 114
Room: TC.5.03 Hörsaal

Symposium
Keywords: social brain, development, evolution, comparative neuroscience

Comparative insights into the development and evolution of the social brain

Chair(s): Magdalena Boch (University of Vienna, Austria), Claus Lamm (University of Vienna)
Discussant(s): Magdalena Boch (University of Vienna, Austria), Claus Lamm (University of Vienna)

Social neuroscience with human adults provides insights into the neural bases of socio-cognitive skills but cannot answer questions about their origins. The human social brain evolved from our ancestors and is the product of adaptation to a changing social environment. It also continues to fully develop until adulthood. In this symposium, we will integrate findings from neuroimaging research with human children and non-human animals to shed light on both the developmental and evolutionary foundations of the social brain.

Studying the development of the neural bases of social interactions, Trinh Ngyuen will tackle the question of *when* neural synchrony in the prefrontal cortex during mother-infant dyads emerges. Moving on to *how* the neural bases of social interactions evolved, Valeria Gazzola will then travel far back the phylogenetic tree and integrate findings from rodents and humans on the involvement of cortical and limbic brain regions in forming decisions to reduce harm for

others. Katherine Bryant will review the ancestral history of the temporal lobe and its role for social behaviour along the hominid lineage and examine which temporal brain functions may be uniquely human. Finally, Magdalena Boch will present findings from comparative studies with humans and dogs to address to *why* the neural bases of social cognition may have evolved, and discuss how temporal brain functions associated with socio-cognitive skills might have coevolved in two phylogenetic distant species but longstanding close companions.

Taken together, the symposium will showcase the power of cross-species comparative neuroscience to advance our understanding of the social brain.

Presentations of the Symposium

Tuned in: Neural synchrony in mother-infant interaction

Trinh Nguyen[1], Drew H. Abney[2], Benett I. Bertenthal[3], Stefanie Hoehl[4]
[1]University of Vienna, Italian Institute of Technology, [2]University of Georgia, [3]Indiana University Bloomington, [4]University of Vienna)

In the present study, we examined the occurrence of neural synchrony in mother-infant dyads. We hypothesized that neural synchrony is enhanced when 4- to 6-month-old infants and their mothers interact compared to when they perceive similar visual input. Sixty-nine dyads participated in two conditions. First, mothers and infants watched an aquarium video for 90 seconds (side by side). Next, mothers and infants engaged in a 5-minute-long free play (face-to-face). We assessed neural synchrony through dual-functional near-infrared spectroscopy measurements over the inferior frontal gyrus (IFG), lateral (lPFC) and medial prefrontal cortex (mPFC). Findings reveal that mother-infant dyads show a significant increase in neural synchrony in the lPFC and mPFC, but not in the IFG, during free play compared to the watching condition, t>3.10, p<.005. The results indicate that neural synchrony in the lPFC and mPFC arises during social interactions of mothers and infants as young as 4-months of age.

How the emotional state of others influences decisions across species

Valeria Gazzola
Netherlands Institute for Neuroscience

As social species, both humans and rodents spend significant time with other individuals. In order to appropriately and successfully interact, it becomes important to sense the current emotional state of our conspecifics. During my talk I will illustrate which brain regions are involved in the perception of the emotions of others and how such activity influences the ability to learn and decide to avoid harm to others, across humans and rodents.

Temporal lobe evolutionary specializations facilitate human social cognition

Katherine L. Bryant[1], Christina N. Rogers Flattery[2], Matthias Schurz[3]
[1]Université Aix-Marseille, [2]Harvard University, [3]University of Innsbruck

Comparative research offers insights into both putative structural modifications that underpin human social cognitive abilities, and information on the timeline of these evolutionary developments. The temporal lobe is an evolutionary innovation that originally evolved for complex object-based visual processing necessary for the primate lifestyle. In addition to significant volumetric expansion compared to other primates, the human temporal lobe appears to have been co-opted from its original function to enable a wide variety of cognitive functions that enable social behaviors, including facial recognition, complex communication, storing and accessing concepts about social entities, and processing emotions. Some of these modifications appear to have evolved in the hominid lineage (e.g., configural face processing, Theory of Mind, and symbolic representation), while others may be uniquely human.

Comparing brain areas for social cognition in dogs and humans: A case on convergent evolution?

Magdalena Boch[1], Isabella C. Wagner[1], Sabrina Karl[2], Ludwig Huber[2], Claus Lamm[1]
[1]University of Vienna, [2]University of Veterinary Medicine Vienna

Perceiving other individuals and their actions are important social skills in our everyday life. Analogous to humans, dogs are able to perceive facial and bodily social and communicative cues and they (over-)imitate actions of conspecifics and heterospecifics, but the neural correlates of these abilities remain largely unstudied. In my talk, I will integrate findings from a series of functional MRI studies with fully awake and unrestrained pet dogs and humans comparing the neural bases underlying the perception of social stimuli (i.e., faces and bodies) and action observation. I will discuss how the temporal lobe, a brain structure which has evolved in parallel in the two species, plays an important role in the perception of social information in dogs and humans, and review how the differences and similarities in brain responses these studies uncover might point at differences in the neuro-cognitive systems the two species rely on to perceive others.

ID: 122
Room: TC.5.05 Hörsaal

Symposium
Keywords: Gaze, Eye Contact, Context

Current advance in healthy and abnormal gaze processing

Chair(s): Nicolas Burra (University of Geneva, Switzerland)

The human face provides essential information for interaction with others: it provides information about identity, emotional state, and the direction of another's attention and intent, primarily through the gaze. In this symposium, the speakers aim to discuss the involvement of both stimulus characteristics and contextual information, also called bottom-up and top-down processing, in gaze perception in healthy and abnormal gaze processing. We will present a current overview of this issue, combining evidence from human behavior, as well as neuroscientific evidence, in healthy and abnormal gaze processing and. First, Marie Noëlle Babinet will present a theoretical and empirical overview of behavioral studies of healthy and abnormal gaze processing. Then, Domile Tautvydaite will present an empirical overview of EEG evidence of the "gaze contact effect", highlight the controversy associated with the studies, and propose how context can resolve this controversy. Next, Desiree Lopis will discuss the role of the "gaze contact effect" on human cognition in the young and aging population and how multimodal context might underscore it. Finally, Agnieszka Wykowska will extend the question of gaze to the question of how embodied humanoid robots can engage in socially salient mutual gazes with human. This body of work will greatly expand our understanding of gaze processing and the topicality of the issue of context in perceptual experience, should be of interest to cognitive neuroscientists, neurophysiologists, and clinicians interested in social perception, as well as to the broad ESCAN audience, and will allow us to identify future challenges.

Presentations of the Symposium

Eye direction detection and perception as premises of a social brain: behavioral data

Marie-Noëlle Babinet[1], Manon Cublier[2], Caroline Demily[3], George A. Michael[4]
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The eyes and the gaze are important stimuli for social interaction in humans. Impaired recognition of facial identity, facial emotions, and inference of the intentions of others may result from difficulties in extracting information relevant to the eye region, mainly the direction of gaze. We review behavioral data demonstrating the importance of eye region and how humans respond to gaze direction, and several theoretical models on how visual gaze information is processed are discussed to propose a unified hypothesis. Several issues that have not yet been investigated are identified and new experiments that could help advance in this area are proposed. Finally, disordered gaze direction detection mechanisms and their consequences on social cognition and behavior are discussed as key deficiencies in several conditions, such as autism spectrum disorder, 22q11.2 deletion, schizophrenia, and social anxiety disorder.

Effect of perceived eye gaze on the N170 component

Domile Taudvydaite[1], Ines Mares[2], Nicolas Burra[3], Atsushi Senju[2]
[1]University of Geneva, [2]Birkbeck, University of London, [3]University of Geneva, Switzerland

Direction of another person's eye gaze provides crucial information about their attention and intentions, which is essential for an effective social interaction. We have reviewed studies that analysed the sensitivity of the N170 to gaze direction. A review of the literature suggests that studies involving deviated faces; gaze or face related tasks; and/or dynamic/live stimuli were more likely to report N170 sensitivity to gaze. Face orientation in particular seemed to play a crucial role in the directionality of this effect, with deviated faces being associated with a larger N170 for direct gaze. We will discuss the need to highlighting the complexity of the effect of gaze direction on the N170 component, and the need of systematic studies investigating the combination of these factors.

Direct gaze effects in normal ageing and in Alzheimer disease

Desirée Lopis
ULR 4072 - PSITEC - Psychologie : Interactions Temps Émotions Cognition Lille University - F-59000 Lille, France

Among all gaze directions, direct gaze implicitly influences a wide range of cognitive processes and behaviors. It captures attention and receive prioritized visual processing. It leads to general positive appraisals of others and increases memory for face identity. Tese "Watching Eyes" effects mainly reflect a positive impact on human cognition and, for this reason, could have a therapeutic potential. They may be used to enhance communication quality, by promoting positive evaluations of others, and stimulate face memory. The data I'll present will show that direct gaze effects are preserved in normal ageing and in Alzheimer Disesase patients: perceiving a direct gaze influences positively others' appraisal and can increase memory for faces and for names. These findings will be discussed in the context of their clinical implications. Some cognitive stimulation strategies for AD patients involving direct gaze will be evoked.

Mutual gaze, attention and cognitive control

Agnieszka Wykowska, Kyveli Kompatsiari
Italian Institute of Technology, Genova, Italy

Mutual gaze with a social interaction partner is a strong signal. In this presentation, we will demonstrate that also embodied humanoid robots can engage in socially salient mutual gaze. However, although socially engaging, mutual gaze can be distracting, and thereby, challenging for cognitive control. In a series of experiments, we show

that mutual gaze (i) despite being irrelevant to the task, prolongs enhanced processing of stimuli presented in gazed-at location, in a gaze-cueing task (ii) delays responses, influences participants to choose suboptimal strategies in a social decision making task, (iii) elicits larger cognitive conflict, relative to averted gaze in a Simon task. Taken together, these results indicate an antagonistic relationship between processing social signals and cognitive control. Most importantly, our collection of studies show that humanoid robots can be used as proxies of social interaction, informing us about socio-cognitive mechanisms of the brain.

ID: 139
Room: TC.5.13 Hörsaal

Symposium
Keywords: social interactions, emotion, mimicry, learning

Psychological processes in naturalistic social interactions

Chair(s): Milica Nikolic (University of Amsterdam, Netherlands, The)

Psychological processes have been traditionally investigated isolated, within an individual. However, as humans are a highly social species, these psychological processes occur, almost always, within social interactions with other people. The extent to which psychological processes shape and are shaped by social interactions in which they occur has been, so far, understudied. Thus, the findings on psychological processes from laboratory studies cannot easily be translated to real-world behaviors.

This symposium brings together novel research from different laboratories investigating psychological processes within naturalistic social interactions in children, adults, virtual humans, and great apes. First, Dr. Antonia Hamilton will present two studies in which her lab investigated 1) whether social interaction impacts learning and 2) what are the behavioral and cognitive mechanisms of interactive learning. Second, Evania Fasya will present a study in which she examined whether people mimic virtual humans and whether these mimicry behaviors predict social affiliation, including liking, desire for future interaction, and trust in the virtual humans. Third, Dr. Milica Nikolić will present two studies in which she investigated whether facial and physiological emotional signals of 1) children and 2) adults during face-to-face interactions influence partners' cooperation with these children and adults. Finally, Dr. Mariska Kret will present a set of studies in which she examined the role of emotional expressions during social interactions in humans and great apes.

Together, these studies will offer new insights into psychological processes appearing within social interactions and advance our understanding of how psychological processes evolve in the real world.

Presentations of the Symposium

Learning is better with others: evidence from online and face-to-face experiments

Sara De Felice, Antonia Hamilton
University College London

What is the role of social interaction in learning? We designed a paradigm where participants learned a series of unknown facts in different (social) learning contexts. First, in online contexts, people learned better in live-video calls compared to yoked recorded videos. Seeing the face of the teacher improved learning specifically in live but not recorded sessions. Second, we present a large fNIRS hyperscanning study where 30 dyads learned in conversation with their partner, alternating roles between teacher and student, while audio, video, head-movement, physiology and brain data was collected. This data is currently being analysed, and will contribute to identify behavioural and cognitive mechanisms associated with social learning, as well as its neural signature. We predict that neural synchrony may be a good predictor of learning, and this relation may be modulated by behavioural factors (e.g. joint attention). Overall, we argue that being part of social interaction catalyses learning.

Mimicry of visual humans and its effect on social affiliation

Evania Fasia, Mariska Kret
Leiden University

This research aims to explore mimicry by making use of virtual humans, specifically, we investigated whether people mimic virtual humans' explicit and subtle expressions and whether this mimicry behaviour predicts positive evaluations of the virtual humans. Participants observed ten virtual humans telling a story on a screen display. At randomized-counterbalanced timepoints, the virtual humans showed four types of expressions: smiles, head movements, pupil dilation, and blushing. The results show that participants mimicked the virtual humans' smiles and that smile mimicry predicts the evaluation, the desire for future interaction, and trust toward the virtual humans. These results build on previous research showing that the mimicry of smiles acts as a social glue and also benefits virtual social interactions.

The effects of facial and physiological emotional signals in face-to-face interactions on partners' cooperation

Milica Nikolic[1], Chris Riddell[2], Bram Van Bockstaele[1]
[1]University of Amsterdam, [2]Leiden University

How do we decide with whom to collaborate and with whom not? In this study, we investigated whether emotional signals one partner expresses in the face-to-face dyadic interaction predict the other partner's decision to collaborate. We examined this question in 8-12 years old children (N=120 dyads) and adults (N=110 dyads) who sat opposite of each other and introduced themselves to each other while we manipulated their visibility: half of the dyads could see and hear each other and the other half could hear but not see each other during this interaction. Afterward, we asked them to play a one-shot Prisoner's dilemma game to measure their collaboration. The data has now been collected and we will analyse facial and physiological emotional signals of partners in the dyad and whether these signals predict collaboration on the individual and dyadic level in the visible but not invisible condition.

The role of emotional expressions during social interactions in humans and great apes

Mariska Kret
Leiden University

Social species' capacity to express, recognize and share emotions enables them to navigate their social worlds and forms a core component of what it means to be socially competent and healthy. In order to evaluate another's trustworthiness, they rely on various indicators of a safe interaction including emotional expressions. The focus of most emotion research has been on explicit, isolated facial expressions. However, during interactions in real life, expressions can be more subtle, mixed and ambiguous and go beyond the facial action units (e.g. blush, tears, pupil dilation). Further, the face is not perceived in isolation, but in the context of the body. In this talk, I will present a series of studies in humans and great apes, giving insight into the role of emotional expressions, in all their complexity, in social interactions.

ID: 134
Room: TC.5.15 Hörsaal

Symposium
Keywords: neurofeedback, biofeedback, mental health, stress, anxiety

Bio-/Neurofeedback in mental health: Recent advances and new challenges

Chair(s): Florian Krause (MaastrichtUMC+ & RadboudUMC, Netherlands)
Discussant(s): Florian Krause (MaastrichtUMC+ & RadboudUMC, Netherlands), Gustavo Pamplona (University of Lausanne, Switzerland), Franziska Weiss (Heidelberg University/Medical Faculty Mannheim, Germany), Abele Michela (Radboud University Nijmegen, Netherlands)

Mental health issues are one of the most threatening global health problems of our time. Not only are they among the disorders with the highest disease burden, but they are also alarmingly common world-wide. Previous efforts to reduce their prevalence have remained largely unsuccessful, and the ongoing global COVID-19 pandemic has even led to another substantial increase. It is clear by now that mental health issues have become a fast-progressing world-wide societal problem that needs urgent attention and new solutions to mitigate it. Potential solutions might come from recent advances in the field of *bio-/neurofeedback*, a cognitive and affective neuroscience-based method for training the voluntary self-regulation of clinically relevant physiological (biofeedback) and neural (neurofeedback) parameters. Continuous methodological improvements and a progressively more complete understanding of the working mechanisms now create the unique opportunity to explore the full clinical benefits of this method and to develop new non-invasive clinical applications. This symposium brings together European early-career researchers who have pioneered the recent advances in biofeedback (Michela) and neurofeedback (Krause, Pamplona, Weiss), and have pushed the field forward with innovative novel methodological approaches that take bio-/neurofeedback into new directions and opened exciting novel clinical opportunities for mitigating mental health issues by reducing anxiety (Weiss), sustaining attention (Pamplona) and strengthening resilience (Krause, Michela).

Presentations of the Symposium

Getting stress-related disorders under control: a unique opportunity for neurofeedback-based therapy

Florian Krause
MaastrichtUMC+ & RadboudUMC, Netherlands

Current first-line treatment for stress-related disorders, such as anxiety or mood disorders, usually consists of a combination of psychotherapy and pharmacological interventions. Unfortunately, these treatments alone are not sufficiently effective as efforts to reduce the high prevalence of stress-related illness were unsuccessful so far. Recent advances in neuroscience have opened the door for new innovative approaches that embrace new insights about the underlying neural working mechanisms of stress and combine them with non-invasive neuro-technology. One particularly promising approach in this field is that of *neurofeedback*, a specific form of biofeedback that can equip individuals with the ability to self-regulate a selected neural parameter. In this talk, I argue that besides existing clinical applications, neurofeedback training has several unparalleled core-strengths not exhausted by current implementations, and show how recent developments could constitute a unique clinical opportunity for neurofeedback-based therapy to mitigate stress-related mental health issues in particular.

Fmri-neurofeedback training of sustained attention

Gustavo Pamplona
University of Lausanne, Switzerland

Attention refers to a complex cognitive process that selects relevant incoming information while ignoring irrelevant input. Attentional deficits are common symptoms in numerous psychiatric and neurological disorders. Neurofeedback can be used to improve attentional skills by allowing individuals to learn control over targeted brain features, a promising route to mitigate symptoms in clinical patients. This talk will summarize the current state-of-the-art in fMRI-neurofeedback applied to attention and various aspects consider when designing such an intervention. I will discuss previously adopted definitions of neural targets, a broad spectrum from regions of interest to large-scale networks. I will also discuss about other relevant experimental design aspects in the context of fMRI-neurofeedback applied to attention enhancement. Specifically, I will talk about explicit versus implicit feedback, the control of physiological signals during neural self-regulation, considerations in the assessment of behavioral effects, and the long-term follow-up effects related to regulation and behavioral effects.

Feasibility of real-time fMRI neurofeedback training for large-scale functional connectivity networks

Franziska Weiss
Heidelberg University/Medical Faculty Mannheim, Germany

Real-time fMRI neurofeedback (rt-fMRI NF) is used for volitional control of brain processes and has delivered unique results in modifying brain activity and improvement of clinical symptoms (Young et al., 2014, Kirsch et al., 2016, Scheinost et al., 2013). As a further development of the method, rt-fMRI NF is increasingly applied for network-based functional connectivity (FC) approaches. However, respirational artefacts are a methodological issue that can interfere with the training (Weiss et al., 2020). Therefore, control for these is important. In a randomized, double-blind, yoke-controlled, pre-registered FC rt-fMRI NF study aiming at up-regulation of FC of the dorsolateral prefrontal-striatal network we have been able to demonstrate a medium effect size training effect despite Global Signal Regression and rigorous control of physiological artefacts in the offline data (Weiss et al., 2022). This shows the capability to develop innovative transdiagnostic circuit-specific interventions for mental disorders and warrants confirmation in a well-powered study.

Training stress resilience in action using a virtual reality biofeedback game in police officers

Abele Michela
Radboud University Nijmegen, Netherlands

Deep breathing and heartrate variability biofeedback have been consistently linked to favourable health outcomes. There is also evidence that the associated increase in paraympathatetic/sympatethic nervous system balance could be beneficial in responding to stressful situations. However, current biofeedback procedures typically are trained in low arousal settings which might not be optimal for transfer to stressful situations and could affect training engagement negatively. We recently developed a virtual reality biofeedback game in the form of a zomby shooter to train biological control in arousing situations. First results from Dutch police officers indicate the game allows for a highly engaging way to effectively promote deep breathing and heartrate variability control.

Thursday 21.07.2022
Oral Presentations Slot III: 14:15 to 15:45 h

PERIPERSONAL SPACE
Room: TC.5.01 Hörsaal

ID: 258

Keywords: Multisensory integration, peripersonal space, temporal binding window, trauma

Early traumatic experiences alter both spatial and temporal principles of multisensory integration

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We process information from the world through multiple senses, and the brain must decide what information belongs together and what information should be segregated. To do so, our brain follows specific spatial and temporal principles with the intuitive consequence that stimuli detected within a specific spatial distance or temporal window are then integrated. These ranges, far from being rigid and pre-established, are rather particularly permeable to the nature of the sensory experiences that are acquired during development. In this context, the potential effect of early traumatic experiences on shaping multisensory processing has been partially theorized but empirically unexplored (De

Klerk et al., 2021; Rabellino et al., 2020). To fil this gap we asked a group of Sierra Leonean adolescent exposed to traumatic experiences to perform an audio-tactile peripersonal space task (Serino et al., 2015; Ferroni et al., 2020) and a simultaneity judgment task (Wallace & Stevenson, 2014) to measure spatial and temporal principle of multisensory integration processing, respectively. Compared to controls, adolescents exposed to trauma showed a narrower multisensory integration space and a wider multisensory integration temporal window. Furthermore, estimates of spatial and temporal multisensory integration correlated with the assessment of clinical consequences of trauma exposure. The present study reveals that being exposed to early traumatic experiences specifically alters the principles governing the processes of multisensory integration, raising interesting reviews of at least some of the clinical sequelae frequently associated with such experiences (e.g., dissociative phenomena, interpersonal deficits, temporospatial distortions).

ID: 270

Observation and imitation of emotions shape personal space in virtual reality

Ivan Patané[1], Clement Desoche[1,2], Romeo Salemme[1,2], Gregoire Verdelet[1,2], Alessandro Farnè[1,2], Fadila Hadj-Bouziane[1]

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This physical distance we set between ourselves and others, called 'personal space' (PS), is the distance that cannot be intruded by people without causing discomfort (Sommer 2002). Although the role of emotions in regulating space is widely acknowledged, the mechanisms of PS regulation remain unclear. We hypothesized that the sensorimotor component of emotions is critically involved in PS regulation. To test this, we used a stop-distance task in a virtual reality setting (Ruggiero et al 2017) wherein participants had to stop a Happy, Neutral, or Anger avatar at a comfortable distance. We measured preferred distance before and after two manipulations affecting the sensorimotor component of emotions. In the observation group (OBS), participants observed emotional faces, while in the imitation group (IMI), participants imitated the same emotional faces. Results showed the OBS group set a larger distance with Angry Avatars after observation, as compared to before. In the IMI group, participants chose a larger distance with Angry Avatars and a shorter distance with Happy Avatars after the imitation session, as compared to before. These results suggest that 1) the mere emotion observation is enough to elicit PS adjustments when facing threatening stimuli (Angry Avatar); 2) imitating emotional stimuli triggers finer adjustments of PS, exacerbating the initial distancing with emotional stimuli (further shortening it toward a positive stimulus and further enlarging it toward a negative one). These findings shed novel light on the framework of embodied cognition of emotions (Stel and Van Knippenberg, 2008), revealing its newly discovered role in PS.

ID: 183

Tool-use extends peripersonal space boundaries in schizophrenic patients

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A primary disruption of the bodily self is considered a core feature of schizophrenia. The "disembodied" self might be underpinned by inefficient body-related multisensory integration processes, normally occurring in the Peripersonal Space (PPS), a plastic sector of space surrounding the body whose extent is altered in schizophrenia patients (SCZ). Although PPS is a malleable interface marking the perceptual border between self and others, no study has addressed the potential alteration of its plasticity in SCZ. Thus, we investigated PPS plasticity in SCZ after a motor training with a tool in the far space. Twenty-seven SCZ and 32 healthy controls (HC) underwent an audio-tactile task to estimate PPS boundaries before (Session 1) and after (Session 3) the tool-use. Results confirm a narrow PPS extent in SCZ. Surprisingly, we found PPS expansion in both groups, thus showing for the first time a preserved PPS plasticity in SCZ. Moreover, patients experienced a weaker differentiation from others, as indicated by a shallower PPS slope (higher values) at Session 1. Patients' weaker PPS boundaries also correlated positively with negative symptoms (i.e. the higher the negative symptoms, the shallower patients' boundaries at Session 1). However, at Session 3, patients marked their bodily boundaries more steeply, suggesting a sharper demarcation of PPS boundaries after the tool-use.

The findings of the present study (Ferroni et al., under review Schizophr. Bull.) highlight the importance of investigating the multisensory and motor roots of self-disorders, paving the way for future body-centred rehabilitation interventions that could improve patients' altered body boundaries.

ID: 360

Pull yourself together: temporal dynamics of the rubber hand illusion

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It is widely accepted that the representation of the body is not fixed and immutable, but rather flexible and constantly updated based on a constant stream of multisensory information. This mechanism can be very useful to adapt to several situations, such as facilitating the use of a handheld tool, but it would not be adaptive if the body representation was too malleable or if it wasn't capable of restoring its integrity after a transient modification. Here we used the Rubber Hand Illusion (RHI) to investigate how quickly the body representation can be modified. There have been some attempts at investigating the timing of the onset and offset of the illusion, however, they lacked a fine temporal resolution. To bridge this gap, we used a potentiometer to record a moment-by-moment rating of the illusion for two minutes during the visuotactile stimulation and for two minutes following the stimulation. Our results show that the illusion is already established during the first 20 seconds of stimulation and that it disappears within 1 minute from the end of the stimulation. This work sheds new light into the temporal dynamics of the RHI and the malleability of the body self-consciousness.

ID: 337

Keywords: gesture, metacognition, confidence, spatial ability, problem solving

Hands of confidence: the role of gestures on spatial problem solving and confidence in answers

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Gestures help cognitive performance by enhancing spatial working memory and facilitating the internal computation of spatial transformations in visualization. They provide exploration and construction of new and efficient solution strategies in solving spatial rotation problems by being a simulated action that activates rich sensorimotor representations of the physical world. This study examined confidence judgments given during a spatial rotation task to see whether the gestures' potential effect on performance is metacognitively monitored. Participants (n = 59, Mage = 21.67, 32 F) completed a spatial rotation task on Zoom via Pavlovia generated links in either gesture or control conditions. Participants were encouraged to use their hands during problem-solving in the gesture condition. The task consisted of twenty-four problems, and the participants gave confidence evaluations for their answers after each. They also completed another similar task on spatial problem solving, which was given to measure metacognitive accuracy on their own. We observed that the experimental group itself did not predict task performance, but gender and group predicted task performance together. Males lost their confidence as they used gestures, but the reverse pattern was observed for females; they benefited from being in the gesture group in terms of confidence and accuracy. Also, the participants regulated their confidence judgments based on the problem difficulty. The results showed the importance of individual-related differences in examining the links between gestures, cognition, and metacognition.

PERSONALITY
Room: TC.5.03 Hörsaal

ID: 340

Keywords: Anxiety, Fear, Event-related Potentials, Adolescence

Anxiety vs Fear: preliminary behavioral and electrophysiological dissociation data in adolescents

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While Anxiety refers to an emotional state characterized by the anticipation of an uncertain future threat, Fear responds to an existing (perceived) imminent threat.

To dissociate these emotional states (often overlapped), a study was developed with 17 adolescents performing visual saliency tasks with EEG and RT recording.

The main goal of this study was to identify neural and behavioral correlates for anxiety and fear.

Results show that salient stimuli elicited P100 and Late Positive Potential, which respectively index basic and cognitive processing of visual information.

Specifically, we found an association between Fear and P100 amplitude, suggesting that higher levels of fear activate more the early visual cortex. A closer look to the construct' dimensions also reveals the specific fear of animals is moderately correlated to the mean amplitude of LPP, therefore associated with a higher neural processing of visual stimuli.

Adolescents with higher symptomatology of panic disorder (a dimension of the anxiety disorders) had lower reaction times, possibly due to their hypervigilance.

Our research enlights the difference between anxiety and fear. On one hand, an arousal condition with no specific object, that maintains the individual in hypervigilance; on the other hand, a survival condition useful for self-protection, that can be adaptive.

If the first condition generally benefits from clinical interventions, reducing its psychopathological weight, the second condition is usually normative, and only in severe cases of phobias a desensitization might be needed.

Our data can be a contribution to promote better interventions with adolescents with different symptomatology.

ID: 326

Feedback-based updating of self-feelings in adolescents and young adults with varying levels of social anxiety: a neurocomputational approach

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Our well-being is affected by how we perceive ourselves and how we process self-evaluative feedback from others. This affective updating of self-feelings seems to differ between healthy individuals and those with social anxiety disorder (SAD). Namely, healthy individuals update their self-feelings more strongly after positive evaluative feedback, whereas individuals with SAD update their self-feelings more strongly after negative evaluative feedback. However, the neurocomputational processes that govern this biased affective updating remain elusive. Further, it is uncertain whether individuals at risk for developing SAD display similar negative affective updating biases. Therefore, the current study administered a task in which 80 adolescents (aged 12-17) and 175 young adults (aged 18-25) performed a speech for 3 virtual judges. After the speech, participants indicated how they had performed by rating 80 evaluative items and received performance feedback on each item from one of the judges. After every trial, participants indicated how they felt about themselves. Changes in self-feelings over time (i.e., affective updating) were dynamically assessed on a trial-to-trial basis via reinforcement learning analyses. Further, EEG reactivity to the prediction errors on each trial (i.e., discrepancy between the self vs. judge ratings) allowed for examining the neural correlates of affective updating during the task. This study should provide crucial knowledge regarding the neurocomputational mechanisms underlying (biased) affective updating. This knowledge is essential for successfully treating affective updating deficiencies, which may lower social anxiety symptoms before they become chronic.

ID: 210

Personality and gender differences in the perception of social interactions: an ERP and source imaging study

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Agreeableness is one of the five major dimensions of personality, representing individual variations in empathy, altruism and cooperation. Previous work has linked agreeableness with socio-cognitive abilities, also detecting a common neural network underlying individual differences across both domains. Another well-established factor affecting social cognition is gender. Building upon these findings, in the present study we assessed the impact of agreeableness on social interaction perception, a pivotal aspect of social cognition, while taking into account gender differences that might moderate this relation. Sixty-two young adults were selected from a larger sample screened for agreeableness, in order to increase in-sample variance. They underwent EEG recording while performing a social interaction detection task. An event-related potential (ERP) analysis was carried out through a mass univariate approach. Behavioral results revealed a trend showing that higher agreeableness scores predicted better ability to detect social interactions in males. In line with this finding, a significant correlation between agreeableness and ERP differences from social and non-social conditions was found only in males, soon after the end of the stimulus presentation. In particular, male subjects with higher agreeableness scores showed more negative contrast values reflecting a greater frontal negativity for social vs non-social trials. Furthermore, source estimation procedure showed a prefrontal and parietal involvement for this ERP effect. The present findings extend previous research on personality and gender-related differences in social skills by showing how neural mechanisms underlying social interaction perception are modulated differently across males and females in relation to their agreeableness trait.

ID: 339

The dark side of personality an unsupervised machine learning approach

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The dark triad attempted to explain the literature on aversive personalities within the typical spectrum of behavior, and three elements have remained: Machiavellianism, subclinical narcissism, and subclinical psychopathy. Personality researchers have recognized that some of the known personality patterns of antisocial behavior like the well-recognized selfishness and callousness of offenders are not just a matter of temperament but a matter of thinking deeply rooted in a cognitive and neurobiological level. Uncovering the neurobiological abnormalities that may contribute to the manifestation of dark triad traits is an important step towards understanding the etiology of these disorders. Few univariate neuroimaging studies have focused on the Dark Triad characteristics separately, producing contradictory conclusions of distinct structural and functional changes due to the limitations of univariate methods. For the first time using a data-driven multivariate approach, our study aims to identify spatially independent GMC (Gray matter components) that predict the overall Dark Triad and separate these components in terms of the Dark Triad subscales. Our results suggest that Dark Triad traits such as violence, antisocial behavior, moral violations, and empathy impairments are closely linked with GMC variations in several subsystems (IC6 and IC 14). Moreover, our findings indicate that GMC alterations in distinct subsystems can be differentiated in terms of the Dark Triad subscales.

ID: 193

The positive dimension of schizotypy is associated with a reduced attenuation and precision of self-generated touch

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The brain predicts the sensory consequences of our movements and uses these predictions to attenuate the perception of self-generated sensations. Accordingly, self-generated touch feels weaker than externally generated touch of identical intensity. In schizophrenia, this somatosensory attenuation is substantially reduced, suggesting that patients with positive symptoms fail to accurately predict and process self-generated touch. Here we hypothesized that a similar impairment might exist in healthy nonclinical individuals with high positive schizotypal traits. One hundred healthy participants (53 female) scored for schizotypal traits and underwent a well-established psychophysics force discrimination task to quantify how they perceived self-generated and externally generated touch. The perceived intensity of tactile stimuli delivered to their left index finger (magnitude) and the ability to discriminate the stimuli (precision) were measured. We observed that higher positive schizotypal traits were associated with reduced somatosensory attenuation and poorer somatosensory precision of self-generated touch. These effects were specific to positive schizotypy and were not observed for the negative or disorganized dimensions of schizotypy. The results suggest that positive schizotypal traits are associated with a reduced ability to predict and process self-generated tactile stimuli. Given that the positive dimension of schizotypy represents the analogue of positive psychotic symptoms of schizophrenia, deficits in processing self-generated tactile information could indicate increased liability to schizophrenia.

PSYCHOPHARMACOLOGY
Room: TC.5.05 Hörsaal

ID: 157

Dopamine modulates a computational signature of subjective feelings of fatigue

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Fatigue – a feeling of exhaustion – is one of the most prevalent symptoms in primary medicine, particularly in Parkinson's Disease (PD). Recent work has begun to reveal the computational and neural mechanisms of fatigability – the rate that fatigue develops at during demanding tasks – in healthy people. This has revealed that the effects of fatigue on motivation fluctuate on a moment-to-moment basis, with fatigue levels increasing after effortful exertion, and decreasing during rest. However, few studies have directly examined how people's subjective feelings of fatigue develop, nor the underlying neuromodulatory mechanisms. Here, we tested the hypothesis that dopamine dampens sensations of fatigue. PD patients (n=30) performed a task on two separate occasions, either on or off dopaminergic medication. In the task they were required to exert levels of physical effort (20%-40% of max grip strength) or spend the same amount of time resting, to obtain rewards. On each trial after exertion (or rest) they were required to rate their level of fatigue. In line with hypotheses, fatigue ratings increased at a higher rate over trials off medication, than on. Computational and model-free analysis revealed that this was driven by smaller reductions in fatigue on rest trials when off medication, not greater increases in fatigue after effort. Thus, dopamine may play an important role in suppressing sensations of fatigue, and in particular may do so by enabling recovery during periods of rest. These

findings highlight the utility of formal models of fatigue for understanding subjective experiences and underlying mechanisms.

Intranasal oxytocin selectively modulates the processing of emotional faces (EEG)

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The hormone oxytocin facilitates prosocial behaviour and social bonding, however the mechanism underlying this process is contended. fMRI research has revealed that intranasal oxytocin decreases amygdala activation to threats, particularly in anxious individuals, however it is unknown if this is a blanket or stimuli-specific anxiolytic effect. Two electroencephalography (EEG) studies were conducted to assess if 1. intranasal oxytocin modulates rapid neural responses to both emotional faces and non-social threats, and if 2. intranasal oxytocin attenuates the early attentional bias to emotional faces. 40 men received 24IU of intranasal oxytocin in a randomized, double-blind, placebo-controlled repeated-measures study, in two sessions 1-week apart. Anxiety scales were recorded at both sessions. In study 1 participants performed a one-back task where they viewed faces (fearful/happy/ neutral) and non-faces (fear (snakes/spiders) or non-fear (mushrooms/flowers)) and identified repetitions. In study 2 participants performed a dot-probe task, and responded to a Gabor target following the bilateral presentation of two faces (fearful/ happy/neutral). Study 1 revealed that OT modulated the early ERP responses to faces regardless of emotion, and that these oxytocin-induced changes were not related to individual anxiety levels. Non-face ERPs were not modulated by oxytocin, regardless of their threat status. Study 2 revealed that oxytocin attenuated the N2pc (a marker of spatial attention allocation) to emotional faces. Together these findings indicate that oxytocin selectively alters the processing of emotional faces regardless of valence, leading to a reduction in the allocation of attention towards said faces.

Longevity of resting-state oscillatory power changes and connectivity in theta, alpha and beta frequency bands following administration of oxytocin.

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Oxytocin (OT) has been implicated as a key modulator of human social cognition. Studies using intranasal OT (inOT) usually aim to begin experimental procedures with a post-administration delay to maximise inOT's effectiveness. However, the longevity of inOT is deduced from peripheral body fluids and no specification of its neurophysiological effects is currently available.

Here, we aimed to characterize inOT's effects on human resting-state EEG dynamics, in particular on power and coupling in delta, alpha, and beta frequency bands. Nineteen healthy males participated in a double-blind, placebo-controlled, within-subject, cross-over design of 24 IU of IN-OT in 12-min windows from 15-to-1h 42min after administration.

We observed that inOT, relative to placebo, induced an increased power in theta and beta, and decreased power in alpha bands. Furthermore, we observed a decrease in theta-alpha and an increase in alpha-beta coupling. These effects were present throughout the observation span. The absence of significant drug-by-time interactions, on both relative power and coupling measures, suggests an overall stable effect of inOT across the measurement time.

Together, our results provide a characterization of EEG resting-state dynamics following administration of inOT and their longevity. They can direct future research by pointing to specific oscillatory mechanisms that are likely to be impacted by inOT. This is applicable to studies assessing inOT's clinical utility in improving social impairments in various disorders by providing more specific intervention targets.

On the neurobiology of sexual objectification: Oxytocin facilitates cooperative behavior

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Sexual objectification is a social phenomenon having women as the most prevalent victims and it is characterized by a focus on the physical appearance of the sexually-objectified targets, reducing them to bodies with no mind.

Evidence of a reduction of the empathy for social exclusion toward sexually-objectified targets supports the hypothesis that sexual objectification could be the prelude to hostile\competitive behavior toward women.

To define its roots and identify possible solutions, a neural and hormonal characterization is needed. A total of 55 healthy individuals were tested in a double-blind, placebo-controlled, randomized, electroencephalography experiment with a between-subject administration of oxytocin (OT). In a Prisoner Dilemma game, we tested if cooperative behavior can be influenced by sexual objectification and if this effect is modulated by exogenous OT. We were able to determine how sexualization motivates and influences peoples' social decisions and expectations at a neural and behavioral level. Precisely, we demonstrated for the first time that sexualization impairs cooperative behavior toward sexualized vs non-sexualized women partners but this pattern is counteracted by an OT administration. Collectively, these findings show that OT plays a role in antagonizing the negative consequences of sexual objectification, especially when a behavior's comparison between targets is unavoidable.

INTERGROUP PROCESSES
Room: TC.5.13 Hörsaal

ID: 319

Keywords: Self, Reinforcement Learning, Social Learning, Similarity, Computational Modelling

Effect of group identity on preference similarity learning

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Numerous studies have shown that those we perceive as similar tend to be evaluated more favourably. On a societal level the perception of shared values plays a vital role in political movements (Stern & Ondish, 2018) and national identities (Henderson & McEwen, 2005). The current research combined computational modelling with the minimal groups paradigm to investigate whether group identity modulates how we learn about those who have similar and different preferences to ourselves. 61 participants first viewed a series of 32 paintings and indicated whether they liked or disliked each one. They were then randomly assigned to a team and shown four target individual two of whom were on their team and two of which were on another team. Participants completed a preference learning task where, in each trial, they predicted whether the targets liked or disliked a painting and received feedback on their prediction. Unknown to the participants, the preferences of one target from both the ingroup and outgroup was set to be the same as the participants 75% of the time while the other two target's preferences different from the participants 75% of the time. Reinforcement learning modelling was used to derive learning rates for each of the four targets and the learning rates were analysed using a 2(group)x2(similarity) ANOVA. We found a main effect of group in which participants learn faster about ingroup members than outgroup members regardless of their preference similarity. This finding suggests a learning bias towards ingroup members regardless of actual similarity to self.

ID: 182

Keywords: misinformation, social identity, far-right, neuroimaging

Identity motives underlie partisan misinformation sharing in far-right supporters: a neural and behavioral perspective

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Online misinformation poses a significant threat to global challenges, such as the covid pandemic and climate change. This misinformation is disproportionality shared by people with extreme political attitudes, especially among the far right. To understand what psychological and neurocognitive processes underlie misinformation sharing among extremists, we conducted two pre-registered experiments with conservatives and far-right supporters in the US and Spain (N = 1,609) and a neuroimaging study with far-right supporters in Spain (N = 36). Individuals who felt their personal identity was fused with their political group were more likely to share misinformation, especially around sacred moral issues (e.g., immigration and nationalism). At a neural level, far-right supporters showed increased activity in brain regions associated with theory of mind in response to misinformation relevant to sacred values (vs. non-sacred values), highlighting the social nature of misinformation sharing. Analytical thinking was unrelated to misinformation sharing around sacred values (vs. non-sacred values) and fact-checks had little or no effect in this sample, especially among hyper-partisans. We provide evidence that political devotion plays a key role in misinformation sharing and discuss practical implications of our findings.

ID: 149

Keywords: Empathy for pain; Trauma; Genocide

On the impact of the genocide on the intergroup empathy bias between former perpetrators, survivors and their offspring in Rwanda.

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Studying what factors influence the ability to resonate with the pain of others in the aftermath of a genocide and how this extends to the following generation is critical for understand better the perpetuation of conflicts. In the present study conducted in Rwanda, we recruited former genocide perpetrators, survivors and their respective offspring and investigated how their neural response to the pain of others is modulated when they visualized pictures of former perpetrators, survivors or their children. We further evaluated how the impact of the genocide and psychological factors associated with a trauma influenced the results. Results showed that the intergroup empathy bias, that is, a reduced neural response to the pain of the outgroup, is present for both individuals alive during the genocide and their offspring. We also observed that a higher number of stressors experienced during the genocide was associated with a higher reduction of the neural response to the pain of others, even towards the children of one's own ingroup. Finally, we observed that a deliberate and free decision to reconcile is associated with a higher neural response to the pain of others. The results may be central for encouraging reconciliation in peacebuilding programs and for fostering empathic repair after a trauma.

ID: 306

Political spillover or stealth democracy: workplace democracy and democratic legitimacy in Europe

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This paper examines political spillover and stealth democracy hypotheses as complementary mechanisms to account for any relationship between workplace democracy and democratic legitimacy from micro-macro perspectives. At the micro-level, the employee-level analyses reported in this paper suggest that neither workplace nor self-reported membership of trade unions directly affects democratic legitimacy; rather, the past membership of bears on negative influence. The effect of workplace democracy becomes only important when passed through job satisfaction and political interest. The macro-level analysis suggests that only union density affects the democratic legitimacy of the two country-level measures. These results are inclined towards the stealth hypothesis, emphasizing that the absence of workplace democracy does not mean that employees want to get away with these structures. Conversely, union density matters might mean that they want to check on democratic institutions by supplying recruitment to trade unions having legal and mobilization powers exert pressure on them.

ID: 294

The impact of shared Sense of Agency on intergroup dishonesty

Giulio Piperno[1,2], Maria Serena Panasiti[1,2], Riccardo Villa[1,2,3], Salvatore Maria Aglioti[1,2,3]
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Honesty boosts interpersonal trust and cooperation and favors enduring relationships. Information about how moral behavior is shaped by inter-group interactions is scarce. Studies indicate that deception may be considered acceptable when it favors ingroup individuals, regardless of the consequences on outgroups. However, the specific factors that may modulate this type of ingroup-serving, parochial misbehavior remain unclear. Here, we explored the impact of having a shared Sense of Agency (s-SoA) with a team member on the tendency to deceive other groups. In Experiment 1, we validated an on-line version of the Coordination tapping task, a paradigm designed to induce either strong or weak s-SoA by manipulating the success in jointly producing a sequence of sounds with another player. In Experiment 2, participants experienced either a strong or a weak s-SoA and then played the Multi-player Temptation to Lie Card Game, a task that fosters the temptation to lie to another team to increase one's own team monetary gain. Results showed that the Coordination tapping task successfully influenced s-SoA, which was higher for high vs. low coordination with the team member. Moreover, s-SoA had an impact on intergroup dishonesty: when the monetary gain at stake was high, having a strong s-SoA with the team member increased ingroup-serving lies and decreased outgroup-serving lies. These results seemingly confirm the impact of s-SoA over parochial dishonesty and call for future investigations on the link between s-SoA and morality.

PSYCHOPATHOLOGY I
Room: TC.5.15 Hörsaal

Abnormal functional connectivity of the habenula with the default mode network characterize treatment-resistant depression

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Background: Understanding why some patients with depression remain resistant to anti-depressant medication could be elucidated by investigating the neural features of treatment-resistance. A commonly found symptom among patients that do not respond to antidepressants is anhedonia, or the inability to feel pleasure, which has been attributed to disrupted habenula function – a component of the reward network. We evaluated the resting-state functional connectivity (rsFC) related to the habenula to better understand the role of this structure in the pathophysiology of treatment-resistant depression (TRD).

Methods: 35 TRD patients, 35 treatment-responsive patients (TSD) patients, and 38 healthy controls (HC) underwent eyes open resting-state functional MRI protocol. rsFC analyses were performed using the left and right habenula as seed regions. Whole-brain comparisons between the three groups were evaluated. The statistical parametric maps were thresholded at the cluster-level familywise error-corrected $p < 0.05$, with an initial voxel-wise threshold of $p < 0.001$.

Results: Results demonstrated hyperconnectivity of the left habenula and the precuneus cortex and the pre and postcentral gyrus in TRD relative to TSD and HC. In contrast, TSD demonstrated hypoconnectivity of the left habenula with the precuneus cortex, when compared to HC.

Conclusion: We found abnormalities in the habenula circuitry in TRD. These abnormalities are associated with dysfunctional encoding of negative affect and could be linked to the pronounced anhedonia observed in these patients. These results differentiated TRD from TSD, providing preliminary evidence of habenula hyperconnectivity as a key neural mechanism underlying treatment non-responsiveness.

An eye-tracking exploration of the alcohol-related attentional bias in severe alcohol use disorder: Influence of subjective craving and cognitive load

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Introduction: Dual-process models consider that the attentional bias towards alcohol-related stimuli plays a key role in the persistence of alcohol use disorder. They postulate that this bias is stable and reflects the over-activation of the reflexive/impulsive system, independently of the activity of the reflective/control one. Our study aims to test these assumptions by investigating (1) the influence of the reflective system on attentional bias, and (2) the stability of the bias following the variation of subjective craving.

Method: We recruited 60 patients with severe alcohol use disorder (30 with craving for alcohol at testing time, and 30 without craving) and 30 matched healthy controls. Participants performed a free viewing task with images of alcoholic and non-alcoholic beverages. The task was then combined with an auditory selective attention task with two levels of difficulty, mobilizing cognitive resources and thus taping on the reflective system. Eye movements were recorded using an eye-tracking.

Results: Our results show an attentional bias towards alcohol-related stimuli in patients with craving and, conversely, an avoidance bias for alcohol in patients without craving. Healthy subjects did not show any bias towards alcohol. The bias remains stable regardless of the difficulty level of the concurrent cognitive task.

Discussion: Attentional bias does not appear to be influenced by cognitive load, confirming the independence of the reflexive and reflective systems. Nevertheless, the direction of the bias appears to be strongly influenced by patients' subjective craving, calling into question the stability of the bias predicted by dual-process models.

Episodic and affective memory distortions in dysphoria: Bayesian testing of diverging theories

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People who suffer from dysphoria retrieve autobiographical memories that are distorted in episodic content and affective responses, which may contribute to the onset and maintenance of depression. While prominent theories agree that dysphoric individuals retrieve positive memories with reduced episodic detail and diminished positive affective responses, it is not clear whether dysphoric individuals retrieve negative memories with reduced episodic detail and affective responses (in line with overgeneral memory bias theories) or with enhanced episodic detail and affective responses (in line with negativity bias theories). Therefore, we conducted a registered report to compare evidence for competing predictions of these theories and to identify key memory distortions in dysphoria (https://doi.org/10.6084/m9.figshare.14605374.v1). Dysphoric and non-dysphoric individuals silently relived positive, negative, and neutral autobiographical memories before verbally recounting the events. We measured affective responses to the memories with facial electromyography and the amount of episodic detail per memory. Using Bayesian Informative Hypothesis Testing, I will compare evidence for the competing predictions of overgeneral memory and negativity bias theories regarding episodic and affective memory distortions. Moreover, I will discuss evidence for the idea that memories that are retrieved with more episodic details also elicit stronger affective responses, and reveal whether this relationship is altered in dysphoria. Insights from this study may not only help to understand the reliving of emotional autobiographical memories but may contribute to the development of memory therapeutics for depression.

ID: 263

Functional connectivity aberrations of the default mode and salience networks outline the continuum major depressive disorder - bipolar disorder - schizophrenia.

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Introduction: Despite the significant scientific progress in the study of the mechanisms underlying mental disorders, stable biomarkers facilitating their diagnosis and differential diagnosis are lacking. Therefore, we attempted to explore possible functional connectivity differences across some of the more prevalent disorders including Major Depressive Disorder (MDD), Bipolar Disorder (BD), and Schizophrenia (SCZ).

Methods: For this study 107 adult subjects with a depressive episode in the context of MDD (n=29) or BD (n=22), current psychotic episode of SCZ (n=27), and healthy controls (HC) (n=29) underwent resting-state functional Magnetic Resonance Imaging. The individuals in all groups were matched for age and gender. Functional connectivity (FC) alterations were explored by means of Conn toolbox in MATLAB.

Results: Preliminary results demonstrated aberrant FC within the Default Mode Network (DMN), Salience Network (SN), and Frontoparietal Network (FP) in patients compared to HC. Furthermore, intra-network FC alterations in DMN and SN were found to be significantly different between MDD and BD and to a much higher degree between MDD and SCZ. Aberrant FC between hubs of SN and the Dorsal Attention Network was established in the comparison between MDD and SCZ, however, no FC differences were found between BD and SCZ.

Discussion: Our research adds to the growing evidence suggesting the existence of a continuum across mental health, MDD, BD, and SCZ founded upon a degree of alterations instead of categorical distinctions. Furthermore, the hubs involved have a role in social cognition, empathy, self-other distinction, etc. which corresponds to the phenomenological variance in the aforementioned diagnoses.

ID: 211

The CNI model of moral decision making in alcohol use disorders and its links to social cognition deficits

Mado Gautier[1,2], Pierre Maurage[1,2]

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Decision-making in social contexts can be assessed through the use of moral dilemmas. A few studies that have used the traditional moral psychology approach contrasting utilitarian and deontological responses, suggest a utilitarian bias (i.e., maximizing collective welfare) in severe alcohol use disorder (SAUD), but the results are inconsistent. Further, to our knowledge, no study explored this question in binge drinking (BD). This research aims both at extending social dilemmas findings to BD issue while clarifying processes implied by adopting a new approach, the CNI model of moral decision making. This model offers new insights by quantifying sensitivity to consequences (C), to moral norms (N), and general preference for inaction over action (I) in responses to moral dilemmas.

We tested patients with SAUD hospitalized for withdrawal and matched healthy subjects (study 1), as well as binge drinker students and matched students who only consume little alcohol (study 2), on a battery of dilemmas and on two key components of social cognition (i.e., theory of mind and emotion recognition). The influence of psychological variables (i.e., depression, anxiety, social anxiety, interpersonal problems and empathy) were also investigated.

The primarily results showed a reduced sensitivity to moral norms in patients with SAUD compared to control. In contradiction with the utilitarian bias evidenced with the traditional approach, patients with SAUD did not display a greater sensitivity to consequences. They also seemed to have a higher tendency to action than controls. Binge drinkers did not differ from control students on any factor.

Thursday 21.07.2022
Symposia Slot V: 16:15 to 17:45 h

ID: 127
Room: TC.5.01 Hörsaal

Symposium
Keywords: brain, gut microbiome, stroke, stress, neurodegeneration, Alzheimer's Disease

Stroke, stress, and neurodegeneration: brain-microbiome interactions across the lifespan
Chair(s): Isabella Wagner (University of Vienna, Austria)

The gut microbiome is closely tied to brain function and the bi-directional communication between these complex systems has emerged as a critical factor in both health and disease. These interactions appear moderated by the immune system, altogether affecting neural function from early development to old age, regulating how we cope with neural injury, stress and neurodegeneration.

The symposium is dedicated to recent advances in this highly interdisciplinary field. We will kick off with Dr. David Berry who will focus on the early development of premature neonates, demonstrating how perinatal white matter injury is associated with neurophysiological development, immunological markers, and bacterial overgrowth in the gut. Dr. Corinne Benakis will continue with a discussion on stroke pathobiology and associated inflammatory responses. She will show how the immune response to stroke is modulated by the gut microbiome and how this in turn might affect stroke outcome. Dr. Sarah-Jane Leigh will present animal work on how acute stress can transform the gut microbiome and will provide food-for-thought on how such changes might influence brain physiology, cognition and mood. Finally, Dr. Edina Silajdzic will conclude by demonstrating how Alzheimer's disease (AD) might partly be caused by alterations in the gut microbiome. Using faecal transplantation from individuals with AD to rats, she will show how a changed gut microbiome can affect memory, hippocampal neurogenesis and microglia activation.

This symposium aims to bridge the diverse levels of brain-microbiome research with data from animals and humans, bringing together colleagues at the intersection of neuroscience and microbiology.

Presentations of the Symposium

Aberrant gut-microbiota-immune-brain axis development in premature neonates with brain damage
David Berry
University of Vienna

Premature infants are at substantial risk for suffering from perinatal white matter injury. Though the gut microbiota has been implicated in early-life development, a detailed understanding of the gut microbiota-immune-brain axis in premature neonates is lacking. We profiled the gut microbiota, immunological, and neurophysiological development of 60 extremely premature infants, which received standard hospital care including antibiotics and probiotics. We found that maturation of electrocortical activity was suppressed in infants with severe brain damage. This was accompanied by elevated γδ T cell levels and increased T cell secretion of vascular endothelial growth factor and reduced secretion of neuroprotectants. Notably, *Klebsiella* overgrowth in the gut was highly predictive for brain damage and was associated with a pro-inflammatory immunological tone. These results suggest that aberrant development of the gut microbiota-immune-brain axis may drive or exacerbate brain injury in extremely premature neonates, and represents a promising target for novel intervention strategies.

The bi-directional communication along the gut-brain-immune axis in stroke
Corinne Benakis
Ludwig-Maximilians-University Munich

The immune response to acute cerebral ischemia is a major contributor to stroke pathobiology. Besides activation of brain resident immune cells, ischemic stroke is characterized by the recruitment of peripheral immune cells that

participate in the inflammatory response and contribute to brain damage. Commensal microbiota plays a defining role in shaping the immune system, its development, maintenance and function of which depends critically on the relative abundance and composition of the different microbial species. In the recent years, the gut microbiome – the most abundant symbiotic compartment in the body – has emerged as a potent regulator of neurodevelopment and ageing as well as brain diseases including stroke. Today, I will summarize the current findings on the molecular pathomechanisms of the microbiota-brain interaction focusing on the metabolites produced by the gut bacteria which may act as immunomodulators in the context of stroke.

Microbial regulation of acute stress-induced alterations in the gut metabolome: Implications for gut-brain axis signalling

Sarah-Jane Leigh
University College Cork

The physiological effects of stress often manifest in the gut. While there is strong evidence for host-microbiota interactions in chronic stress, little is known in the context of acute stress. Here, we aimed to identify microbial and host metabolites altered following acute stress. Adult male C57Bl/6 conventional (Conv), germ-free (GF) and colonized germ-free (ColGF) mice underwent a 15-minute restraint stress exposure. Caecal contents and colonic mucosal scrapings were collected and underwent untargeted metabolomics analysis. We observed stress induced shifts in caecal metabolites in both Conv and ColGF mice, with reductions in short-chain fatty acids and altered host and microbial tryptophan metabolites. Distinct metabolic pathways were enriched in the absence of a gut microbiome. Several of the stress-responsive metabolic pathways are involved in both gut and brain physiology with potential implications for cognition and mood and may provide a mechanistic basis for stress-related host-microbe dialogue in the gut-brain axis.

Brain-**microbiome interactions in Alzheimer's Disease (t.b.a.)**

Edina Silajdzic
King's College London

Healthy ageing is associated with a diverse microbiota. Evidence suggests that gut microbiota alterations contribute to neuroinflammation in Alzheimer's disease (AD). People with AD display a decrease in diversity of microbiota and an increased prevalence of pro-inflammatory genera, which correlates with pro-inflammatory cytokines in the blood. We investigated whether a gut microbiota signature in AD played a role in cognitive symptoms, neuroinflammation and neuroplasticity. We transplanted faecal microbiota from individuals with AD and age-matched controls into microbiota-depleted naïve adult male rats and assessed microglial activation, hippocampal neurogenesis and memory, anxiety, and depressive-like behaviours. Transplantation of gut microbiota from AD subjects to rats induced impairments in hippocampal-dependent memory. The brains of rats colonized with human AD microbiota also displayed decreased hippocampal neurogenesis and increased microglia activation in the hippocampus, suggesting that symptoms of AD may be, in part, caused by alterations in microbiota in the gastrointestinal tract.

ID: 121
Room: TC.5.03 Hörsaal

Symposium
Keywords: emotions; politics; climate change; pandemic; social cognition

Experiencing emotions in socially and politically turbulent times

Chair(s): Manos Tsakiris (Royal Holloway, University of London, United Kingdom)

The symposium brings together a range of perspectives from social and affective neuroscience to political sciences and social psychology to shed light on the mechanisms, experience and perception of emotions as they have come at the forefront of our social lives. The four speakers will present empirical findings that relate to timely and important social and political issues, from climate change (Herman) and intergroup violence (Ibanez) to political communication (Homan) and affective political behavior (Tsakiris). We hope that collectively our talks will motivate interdisciplinary discussions and highlight the promise as well as the limitations of social-affective neuroscience perspectives on socio-political issues.

Presentations of the Symposium

Body maps of climate change emotions: where in the body do we feel emotions related to climate change?

Aleksandra Herman
Laboratory of Brain Imaging (LOBI), Nencki Institute of Experimental Biology, Polish Academy of Sciences, Poland

Bodily sensations are one of the major building blocks of emotional experience. However, people differ in their ability to recognise their emotions, especially those in response to complex phenomena such as climate change. We investigated whether we can use the bodily sensation maps approach to study emotions related to climate change. 548 participants reported where in the body they feel sensations when they experience distinct emotions and when they think about different phenomena, such as climate change or COVID-19 pandemic. Climate change-evoked

sensations pattern was unique and encompassed activations in the head, chest, abdomen and to lesser extent arms, and deactivations in the legs. Such a pattern of sensations showed some similarity with a range of emotions-maps, suggesting that people feel various emotions towards climate change. Thus, these findings indicate that the emBODY tool might be useful in uncovering the range of emotions individuals experience towards complex phenomena.

The impact of social cognition and interaction on societal settings: from pandemic behaviors to judicial decisions to ideologies of violence

Agustin Ibanez
Director, Latin American Brain Health Institute (BrainLat), Santiago, Chile

Social cognition studies are usually restricted to classical experimental settings. Their potential role in characterizing cognition in the wild (everyday cognition) is not well understood. Here I will present translational applications to describe expert judicial decisions, and prediction of violent behaviors. Study 1 assessed how prosociality predicts the perception of SARS-CoV-2 impacts and responses. Study 2 explores how moral decision-making patterns of criminal judges and attorneys are biased by social information, the use of gruesome language in harm descriptions, and physiological states. Study 2 uses machine learning to establish how social-contextual and individual mental health factors predict violence among Colombian ex-combatants (N = 26,349). We also assessed how these factors were differentially impacted by the aggressors' political ideology (radical left or right wins). The three studies open up a new agenda for developing situated social cognition approaches with translational relevance.

Mirror neuron activity in response to politicians' emotional displays: a pre-registered eeg study

Maaike Homan
Political Science Department, Amsterdam Institute for Social Science Research University of Amsterdam, Netherlands

Emotional politicians can be very persuasive. An angry looking or laughing politician can spur passion in voters . In the current study, we examine Mirror Neuron System (MNS) activation in response to politicians' emotional displays. The MNS is linked to emotion recognition, intention understanding, and empathy. MNS is particularly responsive to the emotions of in-group members. Hence, we expect the emotional displays of politicians who we support (in-party politicians) to elicit MNS, reinforcing polarization. We record electroencephalogram responses during the presentation of dynamic morphed emotional displays of Dutch politicians. Preliminary results suggest that the MNS is most responsive to out-party politicians showing happy displays, suggesting that the MNS is activated in response to the violation of expectations regarding which emotions politicians might display (e.g. out-party politicians being happy instead of angry). Overall, the study provides insights on the role of partisanship in how we process the emotions of politicians.

Feeling the body-politic: the political consequences of emotions through the lens of affective neuroscience

Manos Tsakiris
Centre for the Politics of Feelings, University of London

While the study of affect and emotion has a long history in psychological sciences and neuroscience, the very question of how visceral states have come to the forefront of politics remains poorly understood. The concept of visceral politics captures how the physiological nature of our engagement with the social world influences how we make decisions, just as socio-political forces recruit our physiology to influence our socio-political behaviour. This line of research attempts to bridge the psychophysiological mechanisms that are responsible for our affective states with the historical socio-cultural context in which such states are experienced. We review and present findings and hypotheses at the intersections of life sciences, social sciences and humanities to shed light on how and why people come to experience such emotions in politics and what if any are their behavioural consequences.

ID: 135
Room: TC.5.05 Hörsaal

Symposium
Keywords: functional connectivity, brain coupling, neural communication, Hebbian plasticity, transcranial magnetic stimulation

Inducing neural plasticity in higher-order cognitive networks with advanced non-invasive brain stimulation

Chair(s): Alejandra Sel (University of Essex, United Kingdom), Emilio Chiappini (University of Vienna)

Over the last two decades, there has been a rapid development of new forms of non-invasive brain stimulation that allow direct examination of the influence that one cortical area exerts over other areas through short- and long-range cortico-cortical connections. These advanced brain stimulation techniques are often used in combination with electroencephalography (EEG) offering a very powerful multimodal approach to investigate functional dynamics of neural networks. For example, these techniques can allow accurate examination of the operations in the neural circuits supporting processing both at local level and within neural networks in the motor and sensory cortices.

Moreover, some of these neurostimulation protocols involve the application of pairs of TMS pulses over two brain areas at short intervals. When this is done repeatedly over a period of time, it is also possible to selectively manipulate associative neural plasticity between the two brain regions, strengthening or weakening the physiological influence of one brain area over the other. The evoked effects have been defined as Hebbian in nature. In this symposium we will present a series of investigations that have used TMS alone, and in combination with EEG techniques, to directly examine the neural dynamics operating higher-order cognitive functions. These studies show that it is possible to increase or decrease interregional brain coupling between the nodes of brain networks by evoking synchronous preand post-synaptic activity in the pathways connecting the neural nodes. The strengthening or weakening of the neural pathways results in changes in behavior, as well as in functional connectivity and in frequency communication, within the neural networks supporting human perception and cognition. Altogether, these investigations showcase the ability of this advanced form of brain stimulation to interrogate and reveal local and cortico-cortical dynamics of the human brain with unprecedented spatial and temporal resolution.

Presentations of the Symposium

TMS and EEG indices of motor resonance explored through advanced multimodal method and statistics

Chiara Spaccasassi
Department of Psychology, University of Bologna, Centre for studies and research in Cognitive Neuroscience (CsrNC), Cesena, Italy

Humans are equipped with an extraordinary ability to understand others' actions by mapping the observed movement onto their own cortical motor system. Mu rhythm event-related desynchronization (mu-ERD) recorded through electroencephalography (EEG) and the facilitation of motor evoked potentials (MEPs) induced by transcranial magnetic stimulation (TMS) of the primary motor cortex (M1) represent the two correlates of this motor resonance phenomenon. Yet, whether mu-ERD and MEP facilitation reflect unique or distinct mechanisms is not conclusive, as prior work did not combine simultaneous TMS-EEG recording with a trial-by-trial analysis of the two markers. To address this issue, in the present TMS-EEG co-registration study, participants were asked to observe and execute finger movement. EEG was continuously recorded while single-pulse TMS was administered over the left M1 and MEPs were recorded from the right hand. We found stronger motor cortex recruitment during action execution and observation as shown by mu-ERD. MEPs instead were larger overall during action execution and showed a facilitation specific to the muscles involved in the observed movements. Interestingly, when analysing these two parameters using a trial-by-trial frequentist and Bayesian statistical approach, we did not find any relationship between mu-ERD and MEPs within the action observation condition. These findings support the notion that EEG and TMS indices of motor resonance reflect distinct neural mechanisms.

Inducing phase-resetting by single and repetitive TMS for evaluation and modulation of EEG oscillations

Masahiro Kawasaki & Eri Miyauchi
Faculty of Engineering, Information, and Systems, University of Tsukuba, Ibaraki, JAPAN

TMS to human brain can induce transient enhancements of the EEG oscillations in several frequency bands, leading to a phenomenon known as phase resetting in ongoing cortical oscillations. For instance, we have demonstrated that single-pulse TMS to the visual area of healthy participants induced the phase resetting not only in the TMS-targeted area (visual area) but also in the distinct brain area (the motor area) with a time delay. The result suggests that the single-pulse TMS modulates global phase dynamics and directional information flow among synchronized brain networks. In contrast, the propagation of the phase resetting from visual to motor areas was not found in the major depressive disorder patients, which reveals the decrements of the connectivity and information flow of the brain network. Interestingly, the repetitive TMS (i.e., the periodic applications of the single-pulse TMS) induces the phase resetting with the frequency of the repetition. Our study suggested that the theta-cycle repetitive TMS increased the theta EEG oscillations and modulated the relevant cognitive performance. These findings of the phase resetting suggest the possibilities of the single-pulse and repetitive TMS as the effective mean for evaluation and modulation of the brain networks in relation to cognitive functions.

Manipulating interregional brain coupling changes motor oscillatory activity in the human brain

Alejandra Sel
Centre for Brain Science, Department of Psychology, University of Essex, Wivenhoe Park, Colchester, CO4 3SQ, UK

Oscillatory activity is prominent in the brain and one hypothesis is that it is due to the nature of coupling or interaction patterns between brain areas. We tested this hypothesis by manipulating the strength of coupling between two human brain regions (ventral premotor cortex –PMv, and motor cortex –M1) in two directions (increase or decrease) while carefully controlling for the impact each manipulation had on activity in each individual area. This was achieved by stimulating PMv and M1 with paired pulses of transcranial magnetic stimulation using two different patterns only one of which increases the influence exerted by PMv over M1. We looked at the PMv-M1 connection because it is the major cortical route by which prefrontal cortex might influence, inhibit, and curtail action-related activity in M1. Manipulating PMv-M1 coupling in accordance with Hebbian-like spike-timing dependent plasticity resulted in changes in beta and theta frequencies linked to action control.

Uncovering asymmetric interhemispheric connectivity between human visual motion areas: A ccPAS study

Emilio Chiappini

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Visual experience relies on the fine-tuned integration of local processing. The ability to perceive horizontal motion requires the integration of information between the visual motion areas (V5/MT+). Here, a TMS-protocol named cortico-cortical paired associative stimulation (ccPAS) was used to enhance the V5/MT+ interhemispheric connectivity and causally test the functional relevance of this circuit to horizontal motion perception. In Experiment-1 we showed that ccPAS aimed at potentiating interhemispheric V5/MT+ connectivity determined increased horizontal motion sensitivity. Noteworthy, the effect of left-to-right (compared to right-to-left) ccPAS was greater, suggesting an interhemispheric functional asymmetry. This asymmetry was mirrored by a bias exhibited by Experiment-2 participants towards leftward horizontal motion. Crucially, Experiment-3 demonstrated that this leftward bias could be reversed following right-to-left ccPAS. Here, we revealed a striking functional asymmetry in the connectivity within the visual system. ccPAS proves to represent a unique tool to reveal and validate models of functional architecture of brain circuits.

ID: 130
Room: TC.5.13 Hörsaal

Symposium
Keywords: stress, vulnerability, resilience, stress psychobiology

How to measure stress? Novel approaches and biomarkers to investigate stress resilience and vulnerability in humans

Chair(s): Claudia Massaccesi (University of Vienna, Austria), Sara L. Kroll (University of Zurich, Switzerland)

Stress is a ubiquitous phenomenon in everyday life requiring adaptive response to continuously changing situations. Maladaptive stress responses are a key feature of several psychiatric disorders. However, individuals differ in their vulnerability to develop stress-related psychopathologies and a better understanding of the mechanisms underlying (in)adequate responses to stressors is fundamental to improve prevention and treatment strategies. Therefore, the identification of biomarkers that can predict stress resilience and vulnerability is a major goal in stress research. This symposium will showcase recent advances in the field by presenting novel approaches and biomarkers, as well as ecological methodologies, to investigate physiological and psychological responses to acute and chronic stressors.

Julian Thayer will introduce the Generalized Unsafety Theory of Stress and will describe the circuits involved in safety recognition, with a particular emphasis on heart rate variability as an important biomarker of adequate physiological stress response. João Rodrigues will discuss how locomotion, assessed by means of a novel virtual environment stress test, can be used to predict individual differences in physiological stress responsiveness, highlighting behavior as a promising stress biomarker. Sara Kroll will present distinct affective and physiological stress response structures and their link to the endocannabinoid system as a potential stress resilience factor. Dora Hopf will show how affective touch in everyday life can enhance resilience to chronic stressors via regulation of oxytocin and cortisol, using ecological momentary assessment tools. Sonja Sudamic will talk about beneficial effects of nature on stress and how going for a walk in a natural vs. urban environment alters activity in stress-related brain regions.

Taken together, the symposium aims at providing a better mechanistical understanding of stress resilience and vulnerability.

Presentations of the Symposium

The Generalized Unsafety Theory of Stress: A new perspective on stress

Julian F. Thayer

University of California, Irvine, USA

Our generalized unsafety theory of stress proposes "generalized unsafety" as an evolutionarily preserved, adaptive default state that is necessary for survival. However, in the relatively safe modern world, this previously adaptive response has become deleterious. From an evolutionary neurobiological perspective, brainstem threat response circuits are tonically inhibited by prefrontal emotion and autonomic regulation brain regions and are disinhibited not "goaded into action" by threat appraisals. Critical to the GUTS model is that "safety", not "threat" is the active factor in guiding behavior. In the present talk I will detail the circuit involved in the recognition of safety and provide evidence for the role of the parasympathetic nervous system. We have repeatedly shown resting heart rate variability (HRV; objective measure of safety recognition) to be associated with safety/threat assessments. The GUTS model provides a novel psychophysiological framework as to how stress may "get under the skin" to influence health and disease.

Early behavioral biomarkers of the stress response based on locomotion in virtual reality

João Rodrigues, Stephan Streuber, Erik Studer, Carmen Sandi

École Polytechnique Fédérale de Lausanne, Switzerland

Individuals differ in their physiological responsiveness to stressful challenges, both when measured by their cortisol response or cardiorespiratory markers, making it important to develop tools able to identify predictive markers of these individual differences. In this work, we went one step further and demonstrated that by using virtual reality

environments it is possible to not only adaptively elicit robust stress responses, but also predict how strong these responses will be using early behavioral biomarkers (i.e., before exposure to stress). In this talk I will introduce our standardized immersive multimodal virtual environment stress test (IMVEST) and how we could find strong predictors to the stress response elicited by IMVEST in high-dimensional locomotor responses during exploration of novel virtual environments. We believe these results will stimulate the development of novel behavioral digital phenotyping tools for early detection of stress-vulnerable individuals.

The Stress Factor: Underlying physiological and affective stress response structures and their associations with the endocannabinoid system

Sara L. Kroll[1], Raegan Mazurka[2], Markus Heilig[2], Leah M. Mayo[2]
[1]University of Zurich, Switzerland, [2]Linköping University, Sweden

Stress exposure causes typical physiological responses in humans by activating the autonomic nervous system and the hypothalamus-pituitary-adrenal axis, preparing the body for the classical *fight-or-flight* response. However, individuals differ in their affective response to stress, indicating interindividual differences in stress resilience/vulnerability, but showing poor correlations with physiological stress response. To explore the underlying structure of affective and physiological stress responses, we conducted an exploratory factor analysis using the Maastricht Acute Stress Test (MAST) in healthy subjects (N=103). The factor analysis resulted in three distinct stress factors: *Affective*, *Parasympathetic*, and *Threat stress response*. Moreover, we found an association between plasma levels of the endocannabinoid *anandamide* and *Affective* as well as *Threat stress response.* Our findings provide a better understanding of the underlying factors and link between physiological and affective stress response. Furthermore, results indicate that the endocannabinoid system might be a biomarker for stress resilience and target to treat stress-related psychopathologies.

Cortisol and Oxytocin Concentrations during Covid-19 lockdown: Associations with affectionate touch a**nd individuals' wellbeing**

Dora Hopf[1], Ekaterina Schneider[1], Corina Aguilar-Raab[1], Dirk Scheele[2], Andreas Neubauer[1], Uta Sailer[3], Rene Hurlemann[1], Monika Eckstein[1], Beate Ditzen[1]
[1]University Heidelberg, Germany, [2]University of Oldenburg, Germany, [3]University of Oslo, Norway

Affectionate touch has beneficial effects for mental and physical health. Potential neuroendocrine mechanisms include the release of oxytocin and its regulation of the stress axes. To date, only limited data on diurnal and momentary oxytocin levels in relation to cortisol and stress are available. During the first Covid-19 lockdown, N = 247 participants completed ecologically momentary assessments (EMA) over 2 days each with 6 time-points by answering smartphone-based questions on affectionate touch, their mental state and concomitant saliva samples for cortisol and oxytocin assessment. Hierarchical linear models (HLM) revealed negative associations between momentary affectionate touch and Covid-19 burden, stress, anxiety, and cortisol levels, as well as positive associations with oxytocin and happiness levels. Our results suggest that in times of pandemic affectionate touch can increase endogenous oxytocin and buffer stress on a subjective and hormonal level. This has immediate implications for preventing mental burden during social contact restrictions.

How nature nurtures: Amygdala activity decreases as the result of a one-hour walk in nature

Sonja Sudimac[1], Vera Sale[1], Simone Kühn[1,2]
[1]Max Planck Institute for Human Development, Berlin, Germany; [2]University Medical Center Hamburg-Eppendorf, Department of Psychiatry and Psychotherapy, Hamburg, Germany

Although living in an urban environment comes with many advantages, it is associated with an increased risk for mental disorders such as schizophrenia, mood and anxiety disorders. The amygdala, a stress-related brain region, has been shown to be more activated during a stress task in urban compared to rural dwellers. Nevertheless, intervention studies are needed to demonstrate causal effects of natural and urban environments on stress-related brain mechanisms.

To address this question, we conducted an intervention study investigating effects of a 60-minute walk in urban (busy street) vs. natural environment (forest) on brain activity in regions associated with stress. Amygdala activation was measured in 63 healthy participants, before and after the walk, using fMRI stress paradigms.

As predicted, the findings reveal that amygdala activation remains stable after the walk in urban environment, whereas it decreases after the walk in nature.

To our knowledge, this is the first study to demonstrate causal effects of acute exposure to a natural vs. urban environment on stress-related brain regions, disentangling positive effects of nature from negative effects of city. The results strongly argue in favor of beneficial effects of nature as opposed to urban exposure causing additional stress. This study suggests that going for a walk in nature can have salutogenic effects for stress-related brain regions, and in turn act as a preventive measure against developing a mental disorder. Understanding how environment affects stress-related neural mechanisms aims to influence urban design policies to create more green areas in cities and enhance citizens' mental health.

ID: 143
Room: TC.5.15 Hörsaal

Peripersonal and personal space: Behavioral and neural mechanisms

Chair(s): Georgios Michalareas (Max Planck Institute for Empirical Aesthetics, Germany)
Discussant(s): Georgios Michalareas (Max Planck Institute for Empirical Aesthetics)

The space surrounding the body of an individual is of vital importance as it is there that most of the interactions with the environment occur, with objects or other individuals. What schema is used by the brain to map this surrounding space? The two most important hypothesized schemas encountered in literature are the Peripersonal Space (PPS) and Personal Space (PS). These two schemas differ in their functional role. The Peripersonal Space has been conceived as a utilitarian construct and is considered to be the immediate area around the body within which one can reach or can be approached by objects or individuals. It is hypothesized to serve both defensive and non-defensive functions. The Personal Space has been conceived to reflect an emotional role, being the surrounding area that individuals consider psychologically theirs and into which encroachment can feel threatening or discomforting. It is hypothesized to serve more defensive functions. These two schemas conceived to describe different aspects of behavior, in reality share many common behavioral and neural mechanisms. The purpose of this symposium is to explore these behavioral and neural mechanisms underlying the way humans perceive, model and act in their surrounding space. There was never a more relevant time for understanding such processes as we have entered an age of social distancing due to pandemics and now that virtual and augmented reality are becoming increasingly part of our everyday life. The research presented in this symposium also tackles how such conditions affect the representation of the surrounding space.

Presentations of the Symposium

Peripersonal space, functional networks from nonhuman primates to humans

Justine Cléry
The Neuro-Montreal Neurological Institute, McGill University, Canada

How does the brain process space around us? In the last 30 years, the research on the peripersonal space (PPS) has gathered a lot of interest and debate. However, the definition and the function of PPS is not well established, and a longstanding question is whether we should refer to PPS as a general function or to multiple PPSs associated with distinct functions. Is PPS uniquely defined by the space that we can reach to? with the hand, tools, walking? Is it necessarily a defensive and protective space? Is it necessarily a social space? In the past few years, the neurophysiological bases underlying PPS representations, their interactions and their dynamics have been explored both in humans and in monkeys from multiple functional perspectives. Today, I propose a meta-analysis of this recent research and a unified view of PPS representations.

The role of Peripersonal space (PPS) in mediating self-other interactions

Andrea Serino
University Hospital of Lausanne (CHUV)

Peripersonal space (PPS) defines the portion of space where interactions between our body and the external environment more likely occur. PPS is continuously constructed by a dedicated neural system integrating external stimuli and tactile stimuli on the body, as a function of their potential interaction. This mechanism represents a primary interface between the self and the environment.

Most relevant interactions occur with other individuals. In this talk I will discuss how the PPS system dynamically and plastically regulates during real, virtual or potential interactions with other people. Socially-mediated changes in PPS representation vary as a functions of individual differences personality traits or states.

Investigating the effects of the COVID-19 pandemic on personal space

Daphne J. Holt
Harvard Medical School, Department of Psychiatry, Massachusetts General Hospital

An open question currently is whether the COVID-19 pandemic has altered personal space preferences. We investigated this in two cohorts. First, we measured the size of personal space in young adults immediately before the pandemic began (n= 38) and during the pandemic (n=35). Personal space size was significantly larger in the pandemic-assessed (compared to the pre-pandemic) sample (p = .001). Second, comprehensive assessments of personal space boundaries and responses to intrusions into personal space were collected before and during the pandemic in the same individuals (n=12), using both conventional and virtual reality-based methods. Within these subjects, the size of personal space and discomfort in response to personal space intrusions increased significantly during (compared to before) the COVID-19 pandemic, in response to both real and virtual humans (p < .014). These findings suggest that personal space may have expanded in some individuals during the pandemic, regardless of immediate risk level.

The physiological correlates of the space around the body in autism

Francesca Frassinetti
Department of Psychology, University of Bologna

The space around the body has defined as an action space, peripersonal space, and as a social space in which interactions with others occur, interpersonal space (IP). Previous studies reported that individuals with autism prefer larger or shorter interpersonal space compared to healthy controls. It was also shown that when individuals are exposed to the closeness of an unknown person, the skin conductance response (SCR) increases. Aim of this study is to investigate the relationship between SCR and participant's preferred IP space in children with autism (ASD) and with typical development (TD). We found that ASD children SCR was higher than TD children and it was modulated by confederate's closeness, regardless of the confederate's movement direction (approach/withdrawal). These results provide evidence that SCR, acting as warning signal, contributes to IP distance preference, suggesting a functional link between IP space regulation, social competence and the underlying physiological processes.

The effect of Psychopathy on the perception of interpersonal distance

Georgios Michalareas
Max Planck Institute for Empirical Aesthetics

The presence of another person in our peripersonal and personal space, the area surrounding us, affects our psychological state and the underlying brain mechanisms. In this work we investigate what is the effect of one's capacity for emotional processing on the perceived distance to another agent(avatar) located in the peripersonal and personal space. The capacity for emotional processing is measured through the Psychopathic Personality Inventory-Revised (PPI-R) index. Here we show that individuals with a high degree of psychopathy let the avatar approach them significantly closer than individuals with low psychopathy index. Distance estimation has been shown to be an automatic process performed at early stages of visual processing. Our results imply that when another person is located within the peripersonal and personal space, the neural correlates of psychopathy reach as low as early sensory processing, where such basic features as interpersonal distance are computed.

Thursday 22.07.2022
Oral Presentations Slot IV: 17:45 to 19:15 h

SENSORY SYSTEMS
Room: TC.5.01 Hörsaal

ID: 268

Keywords: olfaction, physicochemical space, interindividual differences

Development of a chemical-perceptual space of olfaction

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As a chemical sense, the molecular structure of an odor determines whether and how it is perceived by humans. However, a clear stimulus-percept mapping as in other sensory systems is yet unknown and studies with large psychophysical datasets remain scarce. The aim of this study is to investigate the ways in which measures of human odor perception are related to the chemical properties of odor molecules and the extent to which personality traits and experience with odors influence them.

To achieve these goals, a sample of 1200 healthy young participants receive a set of ten out of 74 monomolecular odors, which differ in their position in a physicochemical space of odors. The odors are first freely described and then rated according to perceptual dimensions such as pleasantness, intensity, and familiarity. In order to account for interinvididual differences, participants fill in questionnaires about their personality, odor significance and socio-demographic background.

We will present results from the first 500 study participants and focus on relations to chemical structure as well as interinvididual differences in perception.

ID: 321

Keywords: action, EEG, motor control, proprioception, multimodal processing

Cortico-kinematic coherence and the differential weighing of sensory action effects in action planning and execution

János Horváth[1,2], Márta Volosin[1,3], Fanni Kovács[1,4], Sámuel Varga[1,4]

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Everyday actions typically elicit several action effects: pressing a key on the keyboard results in proprioceptive, tactile, auditory, and visual effects. Based on one's intentions, the goal-relevance of these action effects may differ, and it is generally hypothesized that the effects are linked in the corresponding action representation with different (intentional) weights. The goal of the present study was to investigate how the addition of visual and auditory effects to a simple action - pinching a force-sensitive device - affected proprioceptive processing during action execution. 15 adult participants applied force impulses in a steady, self-maintained 2 Hz rhythm. Proprioceptive processing was characterized by cortico-kinematic coherence (CKC): the coherence between the force signal and the electroencephalogram. In separate blocked conditions, each force application elicited a tone, or a light emitting diode flash, or no additional sensory effect. We hypothesized that auditory or visual action-effects would allow representing the action primarily in terms of these effects instead of the proprioceptive re-afference, and thus CKC should be lower in these conditions. The 2 Hz CKC peaks were well-observable at fronto-central electrode sites on the side contralateral to the active hand, but in contrast with our hypothesis, CKC was stronger when visual or auditory action-effects were present. These results indicate that CKC is modulated by the presence of additional action-effects, but suggest that proprioceptive processing increases in such cases, which is at odds with the assumption that salient, distal action effects play a dominant role in action planning and execution in this task.

ID: 309

Keywords: vision, retinotopy, multisensory, somatotopy

Embodied multisensory integration in the human visual system during naturalistic movie-watching

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Our phenomenal experience of the world involves integrating information from multiple sensory modalities - yet how the brain brings together multiple sensory reference frames remains unclear. Recently, it has been demonstrated that BOLD fluctuations throughout the brain can be explained as a function of the activation pattern on the primary visual cortex (V1) topographic map. This class of 'connective field' models allow us to project V1's map of visual space into the rest of the brain and discover previously unknown visual organization. Here, we extend this powerful principle to incorporate both visual and somatosensory topographies by fitting multi-modal connective field models to brain responses during naturalistic movie watching. We show that responses in the higher levels of the visual hierarchy are characterized by multimodal topographic connectivity: these responses can be explained as a function of spatially specific activation patterns on both the retinotopic and somatosensory homunculus topographies. These novel multimodal tuning profiles are in line with known visual category selectivity, for example for faces and manipulable objects. Our findings demonstrate a scale and granularity of multisensory tuning far more extensive than previously assumed. These results demonstrate the intimate integration of information about visual coordinates and body parts during natural viewing conditions - even in the absence of tactile stimulation. Such integration likely supports visually guided movements and our rich, embodied experience of the world.

ID: 150

Keywords: interaction effect, ANOVA, estimation, bayesian informative hypothesis

Interaction effect: do the right thing

Sara Garofalo, Sara Giovagnoli, Matteo Orsoni, Francesca Starita, Mariagrazia Benassi
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How to correctly interpret interaction effects has been largely discussed in scientific literature. Nevertheless, misinterpretations are still frequently observed and neuroscience is not exempt from this trend. We revised 645 papers published from 2019 to 2020 in two of the most prestigious neuroscientific journals, namely Neuron (N = 398) and Nature Neuroscience (N = 247) pertaining to behavioral, cognitive, cellular, and molecular neuroscience, and found that, in the 93.2% of studies reporting a statistically significant interaction effect (N = 221), post-hoc pairwise comparisons were the designated method adopted to interpret its results. Given the widespread use of this approach, we aim to: (1) remark its limitations and how it can lead to misinterpretations of the interaction effect; (2) provide more effective and powerful ways to correctly interpret interaction effects, including both explorative (estimation) and model selection procedures (Bayesian Informative Hypothesis). The talk will provide practical examples and reference to freely accessible online materials to reproduce all examples proposed in R, Jamovi, and Jasp software (https://osf.io/ya9mp/).

ID: 226

Keywords: canine fmri, dog, fmri, somatosensation, social cognition

Investigating the canine brain

C. N. Alexandrina Guran[1,2], Magdalena Boch[2,3], Sabrina Karl[4], Lucrezia Lonardo[4], Ronald Sladky[2], Ludwig Huber[4], Claus Lamm[1,2]

[1]Vienna Cognitive Science Hub, University of Vienna, Vienna, Austria; [2]SCAN Unit, Faculty of Psychology, University of Vienna, Vienna, Austria; [3]Department of Cognitive Biology, University of Vienna, Vienna, Austria; [4]Clever Dog Lab, Comparative Cognition, Messerli Research Institute, University of Veterinary Medicine Vienna, Medical University of Vienna, University of Vienna, Vienna, Austria; alexandrina.guran@univie.ac.at

Neuroscience has long acknowledged the relevance of other model organisms, such as non-human primates and rodents, in research. Investigating brain function in non-human animals is usually highly invasive, additionally often relying on sedation or restraining which makes it impossible to investigate normal brain functioning in vivo. Dogs are useful as a model organism not just because they are highly trainable and can therefore perform MRI studies without sedations or restraining, but they are also particularly interesting as a model organism for social cognition. Indeed, dogs outperform non-human primates when judging non-verbal pointing or gaze cues from humans. Social cognition has been discussed as a driver for the astounding neocortical development in the primate lineage (Dunbar, 1998, 2009).

Combining both behaviour and neuroimaging, we are pushing the boundaries of what is known about the canine brain, both in terms of its general, but in particular its social, functions. Additionally, we are developing best practices in non-invasive canine neuroimaging. In this talk, I would like to summarize several studies using dog fMRI, and outline advances in data collection as well as showing how these are employed by us in two studies on dog brain function and cognition: first, the functional mapping of the somatosensory cortex and second, the observation of interspecies social interactions as an example for social cognition in the canine brain.

SOCIAL INTERACTION
Room: TC.5.03 Hörsaal

ID: 278

Keywords: mimicry, social interaction, affiliation

Copying choice induces liking: an online study of art preferences.

Paula Wicher, Eva Krumhuber, Antonia Hamilton
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It is widely believed that being mimicked makes us like the person more (Chartrand and Bargh, 1999). Does this phenomenon also hold true for copying choices? In an online interactive study using Zoom, 40 participants had live conversations with confederates who did or did not copy their art choices. They then completed measures of perceived warmth and competence to assess first impressions, whilst their facial behaviour was video recorded. The results showed that confederates who mimicked the participants' art preferences were liked more than those who made dissimilar choices. Moreover, copying preferences increased social perceptions of warmth (e.g., friendliness, attractiveness, similarity), but not competence (e.g., art knowledge). Automated facial analysis using OpenFace showed no significant difference in participants' and confederates' facial expressions between conditions (agreement vs disagreement). In conclusion, copying choice seems to be one of the driving factors in likability judgments.

ID: 250

Keywords: loneliness, social interactions, biological-motion, mentalizing, functional neuroimaging

Loneliness is associated with reduced prefrontal activity during social interactions processing.

Łukasz Okruszek, Aleksandra Piejka, Marcelina Wiśniewska
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The accurate interpretation of relationships between individuals is crucial for one's ability to navigate the social world. In line with this notion, multiple studies have shown that social interactions (SI) are preferentially processed compared to independent actions of agents. Similarly, increased activity of social brain networks was observed in response to SI compared to independent dyadic actions. However, the impact of loneliness, defined as the subjective feeling of insufficiency of one's social relationships, on SI processing has not been investigated yet. The current conceptualizations of loneliness stress out its association with increased threat perception and decreased use of top-down mentalizing mechanisms in response to social stimuli. Thus, the current study was aimed to investigate the patterns of neural activity associated with SI processing in lonely (LI) and non-lonely individuals (NLI) selected on the basis of the UCLA-R Loneliness scores. Fifty-two LI (26F; 24.2+/-4.1 y.o.) and fifty-one NLI (25F; 23.8+/-4.2 y.o.) were presented with point-light displays of either typical social interactions (COM), positive/negative social interactions (EMO) or dyadic individual actions (IND) during the fMRI session. Overall, biological motion elicited a larger response in precuneus in NLI compared to LI group. Furthermore, SI elicited increased activity in medial and lateral prefrontal regions associated with semantic processing and theory of mind compared to IND in NLI. However, this effect was absent in LI. These results suggest that loneliness may be linked with decreased use of higher-order socio-cognitive mechanisms in response to SI.

Reward Sensitivity in the Archerfish

Orit Nafcha[1,2], Simone Shamay-Tsoory[1], Shai Gabay[1,2]

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Humans are social creatures, demonstrating sensitivity to the actions and consequent payoff of others. This social sensitivity has also been found in many other species, though not in all. Research has suggested that prosocial tendencies are more pronounced in naturally cooperative species whose social structure requires a high level of interdependence and allomaternal care. The present study challenges this hypothesis by demonstrating, in a laboratory setting, that archerfish, competitive by nature, preferred targets that reward both themselves and their tankmates, but not when the payoff on favour the other passive fish. We also chose the archerfish to be our model since we could exploit their natural ability to shoot down insects by training them to shoot at targets presented on computer screens. This procedure enabled us to examine the prosociality and fairness tendencies of these fish in a controlled and artificial laboratory task. In particular, we tested whether the fish deliberately preferred prosociality targets rewarding both itself and its passive tank-mate (1/1) over targets rewarding only itself (1/0) and whether this preference changed when the passive tank-mate received more food than the active fish (1/2). The results indicated that fish exhibit sensitivity to reward distribution and demonstrate prosocial and fairness tendencies. These findings raise a question about the mechanisms underlying prosocial tendencies and challenge the assumption that interdependence is the sole mechanism for social tendencies.

The role of the medio-prefrontal cortex for belief updating in social interactions

Patricia Christian[1,2], Alexander Soutschek[1,2]

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Previous neuroimaging evidence suggests that the right temporo-parietal junction (TPJ) and medial prefrontal cortex (mPFC) implement mentalizing and belief updating processes which allow predicting the behaviour of others and to strategically adapt one's choices after prediction errors. In particular, the medial frontal negativity (MFN) is associated with violations of social expectancy and reflects whether an outcome matches previous expectancies, whereas frontal theta band power is linked to feedback outcome and the adjustment of ongoing behaviour. Here, we investigated the contributions of these brain mechanisms to belief updating in strategic social decision making. During simultaneous EEG recordings, participants played an adapted version of the iterative Prisoner's Dilemma Game where they had to predict their co-players' intentions to cooperate or defect. The results show that unreciprocated cooperation was associated with a higher MFN amplitude shortly after feedback presentation. Additionally, mPFC and TPJ theta power was increased approximately 500 ms after unexpected non-cooperation relative to expected mutual cooperation. This indicates that the mPFC shows an early activation in response to unexpected free-riding, which may lead to belief updating in the TPJ-mPFC network. In a follow-up TMS study, we tested whether the mPFC has a causal role for belief updating. Our results show that mPFC disruption impaired the updating of predictions about others' behavior after prediction errors compared to vertex stimulation. Our results deepen our understanding of the mPFC's role for predicting and updating mental representations about other's behavior in social interactions.

When parents are socially excluded by their own and another child: A novel event-related adaptation of the fMRI Cyberball paradigm

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Ample work offers insights into the neural correlates of parenthood. Yet few studies consider brain activation during real-time parent-offspring interaction. In this fMRI study, we therefore sampled brain activation of preschool children's parents during a novel event-related adaptation of the virtual ball-tossing Cyberball paradigm (Williams, Cheung & Choi, 2000), for the first time including both fathers (n=48) and mothers (n=40). Parents supposedly participated with their own and an unknown child.

The event-related design allowed us to compare three main conditions (inclusion, exclusion, and [new] re-inclusion) and up to three additional task sub-conditions (catch, observe, throw). Following the fMRI scan (3T Siemens Skyra, 32-channel head coil, T2*-weighted GE-EPI sequence with multiband acceleration factor 3), parents completed several self-reports, including an adapted version of the Need Threat Questionnaire (NTQ; van Beest & Williams, 2006).

In accordance with recent meta-analytic evidence, we found that social exclusion in parents primarily activated brain areas involved in emotion processing and regulation as well as mentalizing (e.g., posterior cingulate cortex, posterior and anterior insula, ventrolateral prefrontal cortex), rather than dorsal anterior cingulate cortex originally linked to "social pain" (Vijayakumar et al., 2017; Mwilambwe-Tshilobo & Spreng, 2021). Furthermore, our analyses revealed a selective decrease in reward-related activation (e.g., putamen) for catch (versus observe) trials during re-inclusion (versus inclusion).

We are currently extending these analyses by examining the influence of child familiarity (own versus unknown child), parental and child biological sex, as well as associations with self-reports (including NTQ scores, perceived paradigm genuineness, and parental caregiving beliefs).

SOCIAL TOUCH
Room: TC.5.05 Hörsaal

ID: 255

Keywords: affective touch, vicarious touch, self-touch, sense of self, depersonalization

Getting in Touch with the Lost Self: Vicarious and Affective Touch in Depersonalisation

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We conducted an online study featuring two experiments in order to examine the relationship between depersonalization experiences (DP) (i.e. feelings of being detached from one's self and body) and vicarious affective touch and self-touch. Experiment 1 examined to what extent DP traits modulate the perceived pleasantness and/or vividness of tactile experiences as imagined being received by the self and other. In experiment 2 we designed a new affective self-touch intervention in order to explore the effect of CT-optimal self-touch stroking on one's dorsal forearm on the perceived pleasantness and vividness of tactile experiences as being received by the self and other. We found that low DP individuals reported higher perceived pleasantness and vividness rating for touch. By contrast, the high DP cohort rated all touch experiences as significantly less pleasant. No significant interaction effects for vividness ratings of touch experiences across low and high DP. In addition, our results suggest that people with low DP rate the perceived pleasantness of the imagined social touch experiences as received by the self higher than if received by the other. Interestingly, in high DP individuals, there is no difference in the perceived pleasantness of affective touch imagined as being received by the self vs the other. Finally, we found that both low and high DP participants, following our tailored CT-optimal affective self-touch intervention on one's own body, report significantly higher ratings of vividness of tactile perception.

ID: 168

Keywords: social touch, bodily self, autism, anorexia

Self-touch and other-touch in anorexia and autism

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With ongoing discussion and critique on the diagnostic criteria for psychiatric disorders , we believe it to be highly important to conduct comparative studies on symptom domains including different populations. One such core mechanism is the disturbance of the self, which can be found in many psychiatric disorders. In order to establish a coherent minimal self-experience – a bodily self – a person needs to perceive signals from within their own body and identify these as their own. Disturbed self-related processes have been suggested to be involved in anorexia nervosa (AN) and in autism spectrum condition (AS). While AN and AS share some symptomatology, it has been suggested that people with AN exhibit a reduced self-other-differentiation, while people with AS display a sharper self-boundary.

Affective touch is considered an interoceptive stimulus, which is especially interwoven with the self in a social context: the first experiences of bodily self-boundaries and social interaction in early life arise from affective touch by the parents.

We here used a self-other-touch-task during functional brain imaging and show an altered neural processing of touch in AN, but not AS participants in somatosensory cortex and posterior superior temporal sulcus. Autistic traits across all participants were related to a reduced difference between other-touch and self-touch in the posterior superior temporal sulcus.

With these results we aim to contribute to a better understanding of commonalities and differences between the diagnoses AN and AS.

Shared representations between touch to self and others in people with high tactile empathy

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We not only infer what other people are experiencing, we sometimes even feel what they feel. This is the case for emotions and physical sensations such as touch or pain. It is often proposed that 'tactile empathy' – feeling touch observed on another person's body - relies on overlapping neural representations between self and others. Seeing someone else touched could trigger similar representations in the observer's own tactile system. Variability in the strength of such crossmodal activation might explain why some individuals report consciously feeling touch on their own body when they see someone else being touched whereas others do not. We investigated shared touch representations using multivariate pattern analysis (MVPA) of electroencephalography (EEG) data. A classifier trained on whole-brain neural activation patterns when participants felt touch to their little finger or thumb, was able to predict which finger was touched when participant observed touch to another person's hand. Only in individuals with high tactile empathy, information cross-generalised between a late tactile and early visual signal. Using carefully matched tactile and visual stimuli, we demonstrate for the first time that we can extract neural signatures regarding the specific location of touch on the hand when it is seen or felt, and that this can be used to test for shared representations between modalities. Because EEG has high temporal resolution, we are not only able to show that representational overlap occurs, but also when it is present. These results further our understanding phenomena such as mirror-touch synaesthesia and vicarious touch and pain.

Social touch at a distance: recognizing types of skin-to-skin touch and their emotional content through auditory signals

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Social touch allows communicating specific emotions and a decrease in socio-tactile interactions is linked to higher anxiety and feeling of loneliness. Hence, with the increase of social isolation, social distancing, and distant communication, it appears timely to allow socio-affective interactions even at a distance. One way to do so would consist in providing social touch signals through another sensory modality. One good candidate is the auditory channel, as skin-to-skin touch is creating vibrations that can be easily transposed into an audio signal. Two experiments investigated the extent to which this would be feasible. The vibratory signals from prototypical skin-to-skin touches were recorded with a violin microphone and amplified by means of basic sensory signal processing. In a first experiment, participants were presented with the sounds corresponding to different social touches (i.e., stroking, rubbing, tapping, hitting). They had to recognize and then categorize these audio recordings. In the second experiment, participants had to recognize and categorize the emotional intention (i.e., love, empathy, joy, impatience, fear, anger) underlying auditorily displayed social touches. The results of the two experiments revealed high accuracies in the recognition and categorisation tasks, suggesting the auditory conversion of skin-to-skin touch to be an effective means to convey information about both the type of social touch and its emotional content. Future research will investigate to what extent these audio-touches can elicit emotional responses in comparison to their tactile counterpart.

Soothing the emotional brain: modulation of the neural activity by tactile social support

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Background: Exposure to negative emotional stimuli activates specific neural networks

in the brain. Social support, such as by one's significant other, can regulate emotional responses and provide comfort, but the neural correlates of social support are mostly unknown.

Methods: In the set of three studies we examined the neural networks activated by (a) the picture of a deceased close person, (b) the sad mental imagery related to the same person, and (c) a more general aversive imagery. To reveal the modulatory effect of the tactile social support, the brain responses were studied under three conditions – (a) being without any social support, (b) holding hands by one's romantic partner, and (c) holding hands by a stranger.

Results: The negative-emotional stimulation activated several brain areas, including the anterior cingulate cortex, the anterior insula and the dorsal striatum. Support by romantic partner reduced reactivity in these areas. Additionally, the functional connectivity between anterior insula and anterior cingulate cortex during personal pictorial stimulation was also reduced when comparing support from the partner and a stranger, and was further negatively correlated with the attachment security towards the partner. In the EEG study, only theta power was observed to be reduced when receiving support from the partner, that further correlated with skin conductance measurement and attachment style.

Conclusion: We demonstrated specific brain reactivity to various negative emotional stimuli and brought the evidence about the neural correlates of tactile social support, highlighting the importance of close others in soothing the emotion-related neural activity and subjective distress.

INTERBRAIN PROCESSES
Room: TC.5.13 Hörsaal

ID: 198

Keywords: emotion, empathy, hyperscanning, fNIRS, theory of mind, empirical aesthetics

Emotion sharing and empathy through art: A study of artist and viewer connections in behaviour and brain using fNIRS hyperscanning

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A fundamental aspect of humans—especially in social contexts—is our ability to process and project our and others' emotional experiences. Reading others' emotions and communicating how we feel are core aspects of empathy, theory of mind, communication, and social engagement. Although humans have a well-documented ability to communicate emotions via bodies and faces, another intriguing ability may also be how and when we do this using other means. Especially visual art is a form of communication that might be especially conducive to sharing emotional experience—'bridging minds' across the boundaries of time, language; space. However, the actual processes and incidence of emotional communication between artists and viewers, at the level of behaviour and especially the brain, has almost never been empirically considered. We introduce a paradigm in which we asked artists to make abstract drawings communicating specific emotions while brain activity was recorded via functional near infrared spectroscopy. We then showed a separate cohort the final drawings and videos of the making process, similarly recording brain activity, time synced to the artists. We show that, behaviourally, artists and viewers do show systematic ability to share emotion across drawings, which also correlates to specific, yet differing patterns of brain activity in target regions connected to emotion contagion, empathy, and perspective taking. Even more, using hyperscanning, we explore the relationship between successful connections—guessing artist intention—and synchronised activation patterns across both parties' brains, opening an exciting door for future arts-related emotion research.

ID: 158

Keywords: Hyperscanning, multi brain stimulation, social interaction, causality, inter-brain synchrony

Inter-brain synchrony & Social behaviour: correlation or causation?

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The simultaneous recording from multiple brains – that is hyperscanning – has led to many reports of inter-brain synchrony among socially interacting individuals. Such states of synchrony appear to facilitate social behaviors such as inter-personal coordination, cooperation and communication. Can we think of inter-brain synchrony as a mechanism that causally facilitates social interaction? This question cannot be answered by simply recording from multiple brains (hyperscanning). It instead requires causal protocols entailing their simultaneous stimulation (multibrain stimulation). I will highlight recent findings and future horizons of this nascent field.

ID: 160

Keywords: EEG, fNIRS, Hyperscanning, Action monitoring

Second person approach to studying cooperative social interactions.

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The embodied-embedded-enactive-extended (4E) approach to study cognition suggests that interaction with the world is a crucial component of our cognitive processes. Therefore, studying cognition without interaction is incomplete. To fill this gap, we studied interacting participants, focusing on both intra- and inter-brain (hyperscanning)

neural activity. In the first study, we invited dyads to perform a visual task in both a cooperative and a competitive context while we measured EEG. We found that mid-frontal activity around 200-300 ms after receiving monetary rewards was sensitive to social context and differed between cooperative and competitive situations. In the second study, we asked participants to coordinate their movements with each other and with a robotic partner. We found significantly stronger EEG amplitudes at frontocentral electrodes when people interacted with a robotic partner. Lastly, we performed a comprehensive literature review and the first meta-analysis in the emerging field of hyperscanning that validated it as a method to study social interaction. Taken together, our results showed that adding a second participant (human or AI/robotic) fostered our understanding of human cognition. We learned that the activity at frontocentral electrodes is sensitive to social context and type of partner (human or robotic). In both studies, the participants' interaction was required to show these novel neural processes involved in action monitoring. Similarly, studying inter-brain neural activity allows for the exploration of new aspects of cognition. Many cognitive functions involved in successful social interactions are accompanied by neural synchrony between brains, suggesting the extended form of our cognition.

ID: 152

Spontaneous dyadic behavior predicts self-organizing interpersonal neural synchrony

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Synchronization of neural activity across brains – interpersonal neural synchrony (INS) – is emerging as a powerful marker of social interaction that predicts success of multi-person coordination, communication, and cooperation. INS is assumed to be intrinsically linked to performance of specific tasks. Here we tested the alternative hypothesis that INS is a self-organizing process by recording spontaneous behavior and neural activity while dyads of participants simply looked at each other. Despite the absence of a structured task, INS emerged spontaneously. Using advanced image processing, deep learning, and computational modeling, we probed the origins of INS in notable behavioral cues – eye contact, body movement, and smiling – that anticipated and Granger caused the emergence of spectrally and spatially specific INS. These results provide compelling evidence that INS is an emergent property of two coupled neural systems: a self-organized entrainment phenomenon that can be studied under natural and unconstrained conditions.

ID: 335

Sync-in with Friends : shared affective processing of sitcom narratives assessed through multimodal synchrony

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Synchronization of brain activity and heart-rate reflects shared narrative processing (Nastase et al., 2019; Perez et al., 2021) or shared attentional engagement (Studlherer et al., 2020). We sought to assess how affective processes were reflected in combining cardiac and brain synchrony in a so-called naturalistic paradigm. We presume shared attentional engagement to be mainly reflected by more consistency in shared neural responses within regions related to sensory processing, and to a lesser extent in shared cardiac responses. We expect synchronization of affective brain areas to be positively correlated to cardiac synchrony.

We acquired large-scale multimodal data, namely fMRI and cardiac pulse, in 6 healthy participants (~40h of data/subject) while they viewed the Friends TV show. We then computed intersubject correlation to estimate synchrony in fMRI (Brain-ISC) and heart-rate (HR-ISC) using a leave-one-subject-out approach.

We found moderate Brain-ISC (Pearson correlation coefficients; r>0.50) in posterior brain areas likely related to audiovisual processing, while lower coefficients were found in anterior areas (r<0.35), as well as in HR-ISC (max r =0.36). We conducted significance and nonparametric statistical tests with surrogate data to estimate null distributions. Our results are in line with previous research showing that synchrony is higher in sensory processing areas, and lower in associative areas. Affective processing may be indicated by HR-ISC variability (from r=-0.20 to r=0.36). We are currently investigating how synchronization of some brain areas may be related to more consistent cardiac responses across subjects. ISC of both modalities seem to be driven by sociocultural affordances presented in the stimuli.

SELF AND OTHER
Room: TC.5.15 Hörsaal

Age-related differences in automatic imitation inhibition: an fMRI study

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Humans tend to automatically imitate others and their actions, and self-other distinction allows us to control and especially inhibit such imitative tendencies. Whereas the past decades were marked by a substantial investigation of the neural correlates of automatic imitation inhibition (AIT) in young adults, research on AIT in adolescents and older adults is lacking. Both adolescence and older age are life periods characterized by important changes at the behavioral as well as at the brain level with regard to socio-cognitive processes. To address this research gap, we compared three age groups (adolescents, young adults, and older adults) in their behavioral and neural correlates of inhibiting automatic imitation. 91 subjects (all females) performed a finger-lifting paradigm (Brass et al., 2000; 2001) while lying in an fMRI scanner.

As expected, older adults showed slower response times than adolescents and young adults, regardless of condition. When calculating the interference effect, adolescents were the most efficient in the control of automatic imitation tendencies, whereas young adults and older adults showed comparable effects. Although largely replicating prior findings based on young adults also in adolescents and older adults, comparison of the three age groups did not reveal any age-related differences in brain activation.

These results suggest that in the motor domain while showing an age-depended slowing of reaction times, the self-other distinction ability of older adults is either preserved or compensated by other mechanisms, a question which deserves further attention.

Becoming someone else: Effects of virtual embodiment of others on self-perception and cognitive performance

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Studies show that not only the sense of bodily self is extremely malleable, but also that virtual embodiment of avatars that look different than one's own body affects social and cognitive processes. Importantly, also temporarily changes in self-concept have been observed. In two studies, we investigated how virtual embodiment affects self-esteem, self-objectification, and in turn, cognitive performance. In an immersive virtual reality setting, we used visuomotor synchrony to induce embodiment of a virtual avatar that represented a superhero in Study 1 and an objectified woman in Study 2. We measured state self-esteem, performance in a math task, implicit self-esteem, and physiological responses to stress (ECG and skin conductance) in the experimental condition (Study 1: synchronously moving superhero avatar; Study 2: synchronously moving objectified female avatar), and control conditions (Study 1: synchronously moving normal female avatar; Study 2: synchronously moving normal female avatar, and asynchronously moving objectified and normal avatar). In preliminary analyses, we observed that while embodiment of a superhero in Study 1 increased the subjective experience of physical strength, in Study 2 we found that the loss of agency reduced subjective physical strength. No significant differences in self-esteem, self-objectification, math performance, or physiological parameters between the experimental and control conditions in either of the studies were found. The results will be discussed in light of current theories of embodiment, and with regard to the development of potential educational and therapeutic applications.

Judging harmful actions strengthens neural interactions between temporo-parietal and frontal areas: a TMS-EEG study

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Judging a scenario where an offender inflicts pain on a victim engages a complex brain network involved in moral cognition. The right temporoparietal junction (rTPJ) is thought process others' intentions, however, it is unclear how rTPJ dynamically interacts with the rest of the network to support moral judgements. To fill this gap, we combined single-pulse transcranial magnetic stimulation (TMS) of rTPJ with simultaneous electroencephalography recordings (TMS-EEG coregistration), while participants watched scenarios where an agent deliberately or inadvertently provoked suffering to the victim (Intentional vs Accidental Harm) and neutral scenarios. Analysis on TMS-evoked potentials (TEPs) revealed two modulatory effects at 20-40 ms following TMS pulse: (i) greater positive right frontal TEPs for Intentional relative to Accidental Harm; and (ii) greater positive left parietal TEPs for Accidental relative to Intentional Harm. Frontal TEPs recorded during observation of Intentional Harm correlated with morality ratings: the greater the frontal TEP, the more

severe the moral condemnation. No similar effects were observed in a control group where TMS was applied over the somatosensory cortex. These findings indicate that rTPJ causally interacts with other nodes of the moral brain network, namely with frontal areas to implement intention-outcome integration for moral condemnation of Intentional Harm, and contralateral parietal areas, possibly to check intentionality in Accidental Harm scenarios.

ID: 163

Self-other distinction across motor, affective, and cognitive representations is neither unitary nor domain-general

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Self-other distinction (SOD) is a mechanism, with which we disentangle self- from other-related mental representations. We investigated two still unresolved questions: (1) whether SOD is implemented via a single mechanism across three types of representations: motor, affective, and cognitive representations, and (2) whether SOD is implemented by domain-general or social cognition-specific processes. Participants (N = 300) performed three SOD tasks (automatic imitation inhibition; visual perspective-taking; emotional egocentricity bias) and two cognitive control tasks (Stroop; stop-signal reaction time [SSRT]). Regarding question 1, the exploratory factor analysis on the SOD indexes across 3 spheres resulted in a three-factor solution (30% of explained variance) instead of a single factor where all SOD indexes would converge. Regarding question 2, the indexes of cognitive control newly added to the factor analysis did not alter the previous 3-factor solution and had relatively low loading on factors. These findings suggest that (1) SOD in different spheres relies on distinct mechanisms and (2) that SOD mechanisms recruit domain-general processes only to a limited extent.

ID: 291

Suppressive TMS over posterior parietal cortex modulate precision and decision-threshold in perceptual inference: a neurocomputational mechanism relevant for subclinical psychosis?

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Maladaptive encoding of evidence precision might bias inferential processes and lead to altered reality-testing. Psychotic-like experiences have been associated with impulsivity and increased precision of sensory evidence in the Random Dot Motion task (RDM; perceptual inference) and the Beads Task (BT; cognitive inference). Neurofunctional studies show that activity in the posterior parietal cortex (PPC) correlates with the quality and quantity of evidence accumulated in RDM and BT. Altered synaptic gain in PPC might hence explain precision imbalances and impulsivity associated with psychosis. By the use of 1Hz repetitive transcranial magnetic stimulation (rTMS), we aimed to evaluate the impact of reduced PPC excitability on perceptual and cognitive inferences. We compared performances of the RDM and BT between participants (N=70) who underwent either a session of 1Hz-rTMS over P4 or of sham-rTMS. By fitting RDM data into hierarchical drift-diffusion models, we phenotyped participants in terms of drift-rate (taken as a proxy of precision of sensory evidence) and decision-threshold. We evaluated between-groups differences in parameters estimates and tested for interactions with subclinical psychotic symptoms. Compared to the sham-group, the rTMS-group showed significantly lower drift-rates and higher decision-thresholds. The effect on drift-rate was larger in the subgroups with higher delusion-like or hallucination-like symptoms. We did not find any significant effect on BT. These findings establish a causal role of PPC excitability in the processing of sensory precision and decision-threshold in perceptual inference and suggest a candidate neurocomputational mechanism in this area possibly involved in subclinical psychosis.

Friday 22.07.2022
Symposia Slot VI: 11:30 to 13:00 h

ID: 123
Room: TC.5.01 Hörsaal

Learning in social and non-social contexts in Autism

Chair(s): Morgan Beaurenaut (PSL Research University, LNC² (INSERM U960), France), Constance Destais (PSL Research University, LNC² (INSERM U960), France), Julie Grèzes (PSL Research University, LNC² (INSERM U960), France)

Discussant(s): Daisy Crawley (University College London), Morgan Beaurenaut (PSL Research University, LNC² (INSERM U960), France), Lei Zhang (University of Vienna), Magdalena Matyjek (Universitat Pompeu Fabra)

Autism is a neurodevelopmental condition characterized by impaired social interactions and by restricted and repeated behaviours. It has been proposed that some of these difficulties derive from impairments in basic learning mechanisms, which might manifest in both social and non-social contexts. This symposium explores a wide range of learning mechanisms in autism, including information integration, feedback sensitivity and reward processing, in both social and non-social tasks. The first speaker will present how the learning mechanisms that drive flexible behaviour change across developmental stages, and how these mechanisms differ in autism. The second speaker will present the results of a reinforcement learning task tackling spontaneous approach-avoidance learning from emotional expressions, in social contexts. The third speaker will focus on learning from combined social and non-social information in participants with high autistic traits, using Bayesian computational modelling. Drawing on neuroimaging and psychophysiological data, the final speaker will discuss differences in social and non-social reward processing that may drive atypical learning in autism. Altogether, this symposium will provide insights into the learning mechanisms in autism from state-of-the-art research using behavioural data, computational models and neuroimaging.

Presentations of the Symposium

Modeling flexible behavior in childhood to adulthood shows age-dependent learning mechanisms and less optimal learning in autism in each age group

Daisy Crawley[1], Lei Zhang[2], Emily Jones[3], Jumana Ahmad[4], Beth Oakley[5], Antonia San Jose Caceres[6], Tony Charman[7], Jan Buitelaar[8], Declan Murphy[5], Christopher Chatham[9], Hanneke Den Ouden[8], Eva Loth[5]
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Flexible behavior is critical for everyday decision-making and has been implicated in restricted, repetitive behaviors (RRB) in autism spectrum disorder (ASD). However, how flexible behavior changes developmentally in ASD remains largely unknown. Here, we used a developmental approach and examined flexible behavior on a probabilistic reversal learning task in 572 children, adolescents, and adults (ASD N = 321; typical development N = 251). Using computational modeling, we quantified latent variables that index mechanisms underlying perseveration and feedback sensitivity. We then assessed these variables in relation to diagnosis, development, core autism and associated symptomatology. Computational modelling revealed that dominant learning mechanisms underpinning flexible behavior differed across developmental stages and reduced flexible behavior in ASD was driven by less optimal learning on average within each age group. In autistic adults, perseveration was positively related to RRB. These findings provide novel insights into reduced flexible behavior in relation to clinical symptoms in ASD.

Spontaneous instrumental approach-avoidance learning in social contexts in Autism

Morgan Beaurenaut[1], Constance Destais[1], Klara Kovarski[2], Rocco Mennella[3], Julie Grèzes[1]
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Autism is defined by impairments in social interactions. Successful social interactions might depend on the capacity to spontaneously adapt our behaviour as a function of social feedbacks, such as emotional expressions of others. Indeed, it has been showed that avoiding/approaching an angry/happy individual (respectively) is intrinsically rewarding, acting as a reinforcer to promote instrumental learning. Since there is evidence for atypical reward processing in autism, we assessed spontaneous learning from socio-emotional feedbacks, using a reinforcement learning task. The novelty of this task is that participants were not told about the presence of facial expressions (angry and happy), and they were not explicitly instructed to learn to avoid or approach them. The relationship between learning and the subjective value attributed to approach/avoidance scenarios was also investigated. Finally, reinforcement learning models were used to characterize the differences in learning strategies across participants with and without autism.

Aberrant uncertainty processing is linked to psychotic-like experiences, autistic traits and reflected in pupil dilation during probabilistic learning.

Lei Zhang[1,2], Isabel V. Kreis[1], Matthias Mittner[1], Leonard Syla[1], Claus Lamm[2], Gerit Pfuhl[1]

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Misestimation of uncertainty and an increased perception of the world as volatile (i.e. unstable) have been linked to aberrant belief updating in autism and psychotic disorders. Pupil dilation tracks belief updating and volatility, but studies linking pupillometric data to autistic-or psychotic-like symptoms are scarce. Here we investigated the relationship between behavioral and pupillometric markers of subjective volatility (ie experience of the world as unstable), psychotic-like experiences, and autistic traits in a healthy sample with a probabilistic reversal learning task. Computational modelling revealed that participants with high psychotic-like experience scores overestimated volatility in low-volatile task periods and showed a decreased pupil response to stimuli that urged belief updating. For autistic-like traits, behavioral results indicated a reduced ability to differentiate between high-and low-risk trials. These findings provide new insights into the relationship between misestimation of uncertainties and autistic and psychotic symptoms.

Responsiveness to social and non-social rewards in autism and autistic traits

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Rewards guide the process of learning by motivating and reinforcing behaviour. However, accumulating evidence suggests atypical responsiveness to rewards, particularly social ones, in autism. This may underlie some of the social difficulties in this condition. Yet, the experimental research is vastly incongruent and often uses social stimuli as rewards that might not be relevant for test takers, such as unfamiliar faces. In two experiments, we measured behavioural, neuronal, and autonomic responses to relevant social and non-social rewards in participants diagnosed with autism and non-autistic individuals with varying levels of autistic traits. The data reveal enhanced psychophysiological processing of all rewards in higher levels of autistic traits -also in clinical autism- and simultaneous typical behavioural performance and lowered self-reported reward responsiveness. Thus, while reward processing is atypical in autism, it is not necessarily deficient. Finally, it is crucial to consider familiarity and relevance of social rewards in the context of autism.

ID: 142
Room: TC.5.03 Hörsaal

Symposium
Keywords: predictive processing, development, embodiment, emotion, neural correlates

Predictive Processing in Development: The ontogeny of predictive minds

Chair(s): Fernando Ferreira-Santos (Laboratory of Neuropsychophysiology, Faculty of Psychology and Education Sciences, University of Porto)
Discussant(s): Anna Ciaunica (Centre for Philosophy of Science, University of Lisbon), Mariana R. Pereira (UCL Great Ormond Street Institute of Child Health), Moritz Köster (Institute of Psychology, University of Regensburg)

Research on Predictive Processing models of brain function has accrued significantly over recent years, with most of this work focused on studying predictive processes in the adult brain. However, given that Predictive Processing is to a large extent a model of how experience is integrated into and shapes brain functions via the dynamics of predictions and prediction errors, it provides a novel and generative framework for considering brain and cognitive development. How do predictions develop from infancy? How are prediction errors encoded in the developing brain? What is the role of significant others in shaping a predictive mind? Does the balance between predictions and prediction errors change across development? Do developmental stages correspond to specific parameter changes in predictive models?

In this symposium, we will tackle some of these questions, arguing for the consilience of Developmental and Predictive Processing approaches in Cognitive and Affective Neuroscience. Specifically, we will address theoretical and methodological issues of Developmental Predictive Processing (Ferreira-Santos), consider early influences on development in terms of embodied predictive views (Ciaunica), discuss emotional development and the development of face perception (Pereira), and the neural correlates of predictive processes in the developing brain (Köster).

Overall, we will showcase the emerging field of Predictive Processing in Development, which offers significant opportunities for advancing the scientific understanding of brain development but, at the same time, faces considerable methodological challenges.

Presentations of the Symposium

"Je suis constuctiviste": The consilience of Predictive Processing and Developmental Science

Fernando Ferreira-Santos
Laboratory of Neuropsychophysiology, Faculty of Psychology and Education Sciences, University of Porto

Jean Piaget's statement "je suis constructiviste" summarizes this seminal Developmental Psychologist's viewpoint, who defined development as the active interplay between the child and her environment. Current models of Predictive Processing (PP, or Active Inference) share the assumptions of Developmental Science, but go one step further in specifying putative neurobiological mechanisms for how past experience and present stimulation interact. As such, one challenge for "Developmental Predictive Processing" will be to map well established developmental models and concepts. In this talk, I will revisit classical notions of Developmental Science from a neuroscientific PP perspective, namely developmental stages and mechanisms of developmental change (Piaget), and the role of social interaction in ontogeny (Vygotsky). I will also consider the methodological aspects of this enterprise, as especially in infancy research, methods that capitalize on testing predictions and measuring prediction errors have been in use for decades, but under different denominations (e.g., habituation, paired comparison).

The first prior: From co-embodiment to co-homeostasis in early life

Anna Ciaunica[1], Axel Constant[2], Hubert Preissl[3], Katerina Fotopoulou[4]
[1]Centre for Philosophy of Science, University of Lisbon, [2]The University of Sydney, [3]University of Tübingen, [4]University College London

The idea that our perceptions, cognitive processes and actions are influenced by prior events and experiences has recently received substantial attention from the proponents of the Predictive Processing (PP) in philosophy and computational neuroscience. However, one basic yet overlooked aspect of current embodied and PP approaches is that human brains, minds and bodies, first develop within another human body.

In this paper we examine how humans self-regulate their homeostatic bodily states and build their most basic self- and world-model, literally through others' bodies, in utero. Crucially, while not all humans will have the experience of being pregnant or carrying a baby, the experience of being carried and growing within another person's body is universal.

Specifically, we define in utero development as a process co-embodiment and co-homeostasis, and highlight their close relationship. We show that the case of pregnancy offers a clear and fundamental example of co-embodiment.

Face and emotion predictive processing in development

Mariana R. Pereira
UCL Great Ormond Street Institute of Child Health

Predictive Processing (PP) proposes a new model of brain function and represents a promising avenue to redefine early development. Since predictive mechanisms seem to be in place pre-natally and given the fundamental role of the environment in prediction building, this framework might provide a computational approach to early specialization processes, such as the processing of facial expressions of emotion (FEE).

This presentation will comprise theoretical and experimental evidence of how PP models provide a cohesive and innovative understanding of the development of FEE processing in two ways: by explaining typical and atypical patterns of face and emotion processing and clarifying some existing confounding results; and by providing a conceptual framework for a hybrid model of emotions, combining the role of affective properties such as the valence and arousal of the facial displays as well as the emergence of emotional categories for prediction building and prediction error modulation.

How infants build basic predictions about the world around them

Moritz Köster
Institute of Psychology, University of Regensburg

A key developmental task for human infants is to make sense of their environment by forming basic predictions about the world around them. I will present convergent evidence from several EEG studies that infants form basic representations and predictions about their environment at the ~4Hz theta rhythm. In a first study we showed increased theta activity in 9-months-olds in response to unexpected vs expected events in classical VOE paradigms. In a second study we tested the functional role of the theta rhythm using rhythmic perceptual stimulation to substantiate the involvement of the theta rhythm in processing unexpected events. I will imbed these findings in a broader theoretical and empirical context, on how the theta rhythms supports the formation of basic representations by integrating novel and unexpected events into increasingly sophisticated representations about the world around them, allowing successful behavioral navigation and development in complex and diverse human life worlds.

Friday 22.07.2022
Oral Presentations Slot V: 11:30 to 13:00 h

EMOTION AND COGNITION
Room: TC.5.05 Hörsaal

Fostering positive emotions through virtual reality: the influence of users' age and video contents on emotional responses

Katarina Pavic[1,2,3], Dorine Vergilino-Perez[1], Thierry Gricourt[3], Laurence Chaby[2,4]

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While a growing number of studies have supported Virtual Reality's (VR) potential to induce positive emotions, fewer studies have examined its effectiveness among healthy elderly users. Additionally, studies reported conflicting results regarding valence and arousal responses in older participants. This may be due in part by the lack of comparison between social and nonsocial video contents on users' emotional responses. Yet, social video contents are known to induce higher levels of arousal and are relevant for inducing positive emotions. Thus, we aimed at investigating the efficacy of highly immersive VR for inducing positive emotions in elderly adults, by confronting 'natural' and 'social' video contents. 36 undergraduates (22.2 ± 2.5 y.o) and 21 older adults (71.0 ± 5.8 y.o) were recruited. All participants watched and rated 360° videos of both contents under a Head-Mounted Display (HMD) and on a computer screen, while their skin conductance and heart rate were collected using the Empatica E4 wristband. Overall, the HMD proved to be more efficient than the computer screen presentation for inducing positive emotions, both on subjective and physiological measures. Additionally, elderly users reported higher levels of arousal compared to their younger counterparts. Social video contents elicited higher levels of arousal only when watched under the HMD. This is most apparent for older participants, who exhibited the highest skin conductance for social video contents in the HMD condition. As these findings support VR's effectiveness for fostering positive emotions in older users, potential applications for a "successful aging" or vulnerable users will be discussed.

Hot and cool cognitive control in toddlers born preterm

Artemis Stefani[1], Kayleigh Day[1], Michelle de Haan[1], Deirdre Murray[2], Neil Marlow[3], Frederique Liegeois[1]

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Premature birth occurring at less than 33 weeks of gestation is associated with difficulties in cognitive control (CC) but these have not been well characterised in the first years of life, and their predictors remain poorly understood. The field of prematurity has focused almost entirely on assessing CC in affectively neutral contexts ('cool') but not reward-based contexts ('hot'), despite well documented socio-emotional difficulties later in development.

Participants were 30 toddlers (30-months-old corrected-age) born preterm (23-32 weeks) and 36 30-month-olds born full-term, from the UCH Preterm Development Project (London, UK). The two groups did not differ in gender, age, maternal education and SES distributions. We used measures of both 'hot' (Snack and Gift Delay) and 'cool' CC (Card-Sorting and the BabyScreen-touchscreen task).

Compared to their full term-born counterparts, preterm toddlers waited for shorter periods for rewards in 'hot' tasks and performed worse on 'cool' tasks when required to switch between complex rules but not when following simple rules. Cognitive performance was reflected in the everyday environment by parental reports. Within the preterm group, worse 'hot' performance was associated with higher neonatal brain lesion severity and lower maternal education while worse 'cool' performance was associated with lower birthweight. Within the preterm group, not using strategic behaviours explained worse 'hot' task performance.

Preterm toddlers present with impairments in both 'hot' and 'cool' tasks, with distinct predictors suggesting potentially differential risk factors and underlying neural mechanisms. The fact that using effective strategic behaviours modulates 'hot' CC performance could have implications for targeted interventions.

How has Affective Neuroscience evolved over the last decades?

Afroditi Giannakopoulou[1], Giada Lettieri[1,2], Giacomo Handjaras[1], Marco Viola[3], Luca Cecchetti[1]

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The development of human brain mapping enabled the study of the neural correlates of affect. Since then, thousands of articles have investigated the relationship between brain activity and the experience of emotion, contributing to the "rise of affectivism" (Dukes et al., 2021).

Here, by analyzing human affective neuroscience literature (from 1980 to 2020), we summarize trends in topics (e.g., emotion, mood), techniques (e.g., fMRI, EEG), and the use of emotion-label words (e.g., happiness, fear).

We searched the Pubmed database for brain studies on healthy adults and coded automated part-of-speech tagging of abstracts to refine the topics inquiry (e.g., affect as a noun).

About 10% of the ~65k retrieved articles include at least one of these topics: emotion appears in ~4.6k abstracts, affect in ~2.0k, feeling in ~0.5k, and mood in ~0.4k. Affective neuroscience articles show an abrupt increase from 2000 (i.e., ~3% of the neuroscientific literature) to 2010 (i.e., ~10%) and then stabilize. They now represent ~11% of the literature with fMRI being the most used technique in emotion (~2.6k) and affect (~1.0k). Instead, there is a comparable number of fMRI and EEG studies in mood. Of note, the frequency of emotion-label words is topic-dependent: fear is the most frequent term in emotion and affect, disgust in feeling, and both happiness and sadness in mood.

Overall, affectivism bloomed between 2000 and 2010, yet, its rising has now reached a plateau. The field is dominated by fMRI studies on emotion, and research has focused on a limited number of emotion-label words.

ID: 215

New directions to crack the acoustic code of emotional prosody

Pauline Larrouy-Maestri[1,2,3], Marc D Pell[2,4], David Poeppel[5,6]
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Prosody conveys paralinguistic information related to one's emotional state, and plays a central role in language and communication. Despite decades of research and important achievements, such as the seminal work of Banse and Scherer (1996), the mapping between acoustics and emotional states remains unclear. Based on a chronological reading of English articles published during the last 25 years, we identify multiple sources of variability that prevent us from definitively characterizing the sound of emotional prosody. The mapping between acoustics and emotions will depend on both variables (i.e., acoustic features and the emotions under study), on the speech material (i.e., its content and selection), but also on more general factors such as culture of the speaker and listener. We focus here on issues related to the speech material. We report recent data that support 1) the benefit of using meta-analyses to quantify its effect on the relation between the acoustics and intended emotions (van Rijn & Larrouy-Maestri, under review), and 2) the benefit of using alternative selection procedure to ensure variability and authenticity in datasets to be analyzed (Holz, Larrouy-Maestri, & Poeppel, 2022). By providing an extensive review, discussing empirical data, and suggesting concrete directions, this presentation aims to elicit constructive suggestions to answer the challenges pointed out (and potentially others) and seek to crack the code of emotional prosody.

ID: 311

The effects of gain and loss avoidance context on feedback processing in a flanker task

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Adaptive behavior is based on monitoring response outcomes and feedback. Neural correlates of feedback processing depend on motivational context, however, there is not much consensus in the literature on direction and type of effects, possibly due to a multitude of tasks and analysis methods used. The current study investigated how neural correlates of feedback processing are modulated by motivational context. We recorded the feedback-related brain activity in the EEG using a monetary incentive Flanker task, with a gain and a loss avoidance context (n = 131). We investigated the effects using single trial analysis. The effects of motivational context varied with feedback type. For negative feedback, regression weights around time windows associated with the FRN and P3a reflected larger amplitudes in the gain context. For positive feedback, regression weights around time windows associated with the FRN, P3a and P3b, reflected larger amplitudes in the loss context. Additional time-frequency analyses revealed a clear effect of context, with higher frontocentral theta power in the gain context for negative feedback. There was no effect of context on delta power. Analyses also revealed a significant effect on positive feedback, with higher frontocentral delta power in the gain context, and higher parietal theta power in the loss context. Motivational context therefore appears to influence neural correlates of feedback processing depending on trial-by-trial changes and feedback type. Understanding these mechanisms could also help elucidating underlying vulnerability factors for various mental disorders, as alterations in feedback processing has been proposed as a transdiagnostic mechanism.

PSYCHOPATHOLOGY II
Room: TC.5.13 Hörsaal

Prefrontal contributions to self-awareness and emotion regulation in dyslexia and ADHD: implications for externalizing symptoms

Eleanor R Palser[1], Nathaniel A Morris[1], Christina Veziris[1], Sarah R Holley[1,2], Ashlin R K Roy[1], Abigail E Licata[1], Christa Watson Pereira[1], Maria Luisa Mandelli[1], Ronald E Dahl[3], Maria Luisa Gorno Tempini[1], Virginia E Sturm[1]
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Dyslexia and ADHD frequently co-occur, and externalizing symptoms, such as aggression and impulsivity, are common but not well characterized. We hypothesized that difficulties in self-awareness of emotion regulation abilities would predict greater externalizing symptoms and relate to the structure of the prefrontal cortex. We used a laboratory-based task to investigate emotion regulation and self-awareness and associations with prefrontal grey matter volume (GMV), and parent-reported externalizing symptoms. Participants included 69 children (ages 7-13; 45% female) who were neurotypical or had dyslexia or dyslexia + ADHD. Participants' subjective ability to regulate their emotions was measured via self-report, and objective emotion regulation was quantified using behavioral coding. Discrepancy between subjective and objective measures reflected self-awareness. Across the groups (controlling for age, sex, nonverbal IQ, and total intracranial volume), greater subjective emotion regulation ability was associated with greater bilateral frontal pole GMV (left: $t = 2.04$, $p = .046$; right: $t = 2.13$, $p = .037$). Better objective emotion regulation was associated with greater right superior frontal ($t = 2.28$, $p = .026$) and left lateral orbitofrontal GMV ($t = 2.59$, $p = .012$). More accurate self-awareness was associated with greater right frontal pole GMV ($t = 2.07$, $p = .043$) and predicted lower externalizing symptoms in the children with dyslexia and dyslexia + ADHD ($t = 2.52$, $p = .017$). Findings suggest that emotion regulation and self-awareness are associated with the structural anatomy of prefrontal cortex and represent novel areas for intervention in children with dyslexia and ADHD.

That did not age well: amygdala-mediated trust learning is impaired in older adults

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Using the repeated trust game, we observed that the amygdala is involved in learning to discriminate trustworthiness (Sladky et al., 2021), a finding that is supported by evidence from participants with amygdalar lesions (Rosenberger et al., 2019). The amygdala's role is complex and different subnuclei are involved at different phases of a trust game round. While the basolateral amygdala (BLA) was active during outcome evaluation, the central amygdala (CeA) was active during the preparation phases, assumingly guiding the subsequent investment behavior. In fact, participants who better learned to differentiate, exhibited an increased amygdala activation when they prepared to interact with the untrustworthy player. Here we investigated if these amygdalar effects can also be observed in senior participants.

Neurotypical participants (29F/21M, age=70.4years) were compared to the population of younger adults (31F/31M, age=24.0years). One run of the repeated trust game was performed while undergoing fMRI as described in our previous publication (Sladky et al., 2021).

In line with our previous observation in young adults, amygdala activation differed across the different task phases. In older people, BLA activation was decreased in the preparation and increased in the other phases. CeA activation was also decreased during preparation and increased in the outcome phase. However, there was no difference for the trustworthy vs. untrustworthy trustee in the amygdala. We observed high variability of amygdala activation, which suggests a reduced amygdala efficacy in trust learning. In fact, learning is indeed reduced in older people, evidenced by less differentiation between players in behavioral trust (p<0.001) and subjective trustworthiness rating (p=0.003) compared to young adults. We also investigated the substantia nigra/ ventral tegmental area and found reduced activation in all phases of the task in older people. In the nucleus accumbens, activity was also reduced during introduction and investment, yet, increased during outcome. However, there was no difference between players in the NAc, indicating less differentiation of the reward values.

In sum, we found that trust learning is impaired in older people. The amygdala, previously found to be important to guide trust decisions, appears to not sufficiently contribute to the learning process possibly due to impaired dopaminergic signaling.

Simultaneous fMRI and pupillometry reveals affective processing in a cognitive task

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In previous work, we showed that pupil size increases with increasing working memory load and is reliably correlated to activity in the frontoparietal network (FPN). Here, we investigate data driven pupil response profiles and its neural correlates in a working memory task in a dimensional cross-diagnostic approach.

The sample consisted of 226 healthy participants and patients with various degrees of affective/anxiety disorders who completed the N-back task during fMRI and simultaneous pupillometry. We used latent class growth modeling to detect data driven subgroups with different pupillometric response profiles. The model with the best fit according to the Bayesian Information Criterion was chosen and the corresponding mean pupil values were entered into general linear models in SPM12. We examined group differences in neurocognitive functioning, depression, and state and trait anxiety.

The clustering resulted in two distinct subgroups: one with a stepwise increasing pupil size with increasing cognitive load (reactive group), the other one with a more constant pupil size across conditions (non-reactive group). Statistical maps of the mean pupil values per condition showed the FPN; the differential contrast indicated that the pupil response profile of the reactive group resulted in less deactivation mainly of the limbic system. Additionally, the reactive group performed better on neurocognitive measures. No differences in depression and state and trait anxiety were observed.

Through examination of data driven growth patterns, we were able to identify individual pupil response profiles during a cognitive task, where pupil size acted as a proxy for cognitive effort as well as arousal.

ID: 162

Strongly held agoraphobic cognitions predict panic diagnosis and reveal a key interoceptive dimension in mental health issues. A machine learning study.

Adrián Yoris, Alvaro Deleglise

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People develop and hold beliefs about broad and different conceptions of the self: a sense of agency, self-esteem, self-perception of embodiment, among many others. Interoceptive beliefs (Suksasilp and Garfinkel, 2022) are related to self-perception of bodily experience that when strongly held may facilitate vulnerability to interoceptive distortions with implications for psychiatric disorders. Although strongly held interoceptive beliefs are relevant to many mental health problems, such as anxiety disorders, their study has been neglected in mainstream interoceptive research, particularly in its Bayesian predictive coding models. In this work, we analyzed the power of strongly held interoceptive beliefs in predicting the diagnosis of panic and social anxiety disorders. By employing a model-based feature selection strategy followed by supervised classifications with Random Forest classifiers we found that panic-related strongly held interoceptive beliefs, as measured by the self-report scale ACQ-physical concern, predicted the correct diagnosis in almost 90% of cases. In social anxiety disorder, the algorithm was equally successful, however, the beliefs that better predicted the diagnosis were essentially social (fear of rejection, measured by the SIAS scale) instead of physical. Overall, this study bears psychopathological models that emphasize the role of strongly held beliefs as a specific psychological vulnerability for the development of mental disorders. On the other hand, it emphasizes the role of interoceptive cognitions of self-perception of embodiment in the development of psychopathology.

ID: 161

Effect of DPP-4 inhibitor on social interaction and hippocampal synaptic plasticity in acute kidney injury: crosstalk through inflammation and energetics alternations

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Patients with kidney disease usually suffer from multiple organ dysfunctions such as cerebrovascular disease, cognitive impairment, and neuropathy. The dipeptidyl peptidase 4 (DPP-4) inhibitors decrease the degradation of glucagon-like peptide-1 (GLP-1), thereby increasing pancreatic insulin secretion and improving glycemic control. The study aimed to investigate the effect of acute kidney injury (AKI) on social interaction; the study also tried to explain the possible underlying role of inflammation, altered energetics of injury, or the possible mode of action of the DPP-4 inhibitor "vildagliptin" on the brain in AKI. Forty adult male albino rats were divided into control, AKI (untreated),

AKI+saline, and AKI+Vildagliptin groups. We evaluated the sociability and social novelty indices, platelets and hippocampal content of mitochondrial enzyme complexes (I-V), serum urea, blood urea nitrogen (BUN), creatine phosphokinase, hippocampal ATP content, hippocampal expression of the glial fibrillary acidic protein (GFAP), activity-regulated cytoskeleton-associated protein (Arc), toll-like receptor 4 (TLR-4), and Nuclear Factor Kappa B (NF-κB). AKI resulted in a marked deterioration in kidney functions, hippocampal ATP content, platelets, hippocampal mitochondrial complexes, sociability, and social novelty indices.

On the other hand, AKI increased hippocampal GFAP, ARC, TLR4, and NF-κB expression. However, these parameters were all ameliorated after saline and vildagliptin treatment, with better hippocampal parameters' results, levels of platelets and hippocampal mitochondrial enzyme complexes, and sociability and social novelty indices with vildagliptin compared to saline treatment. The DPP-4 inhibitor, vildagliptin, showed a promising role against AKI and its CNS-resulted hippocampal functions deterioration by improving inflammatory markers and platelets, and hippocampal energetics.

SOCIAL COGNITION
Room: TC.5.15 Hörsaal

ID: 173

Dynamic causal modeling of cerebello-cerebral connectivity when sequencing trait-implying actions

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Prior studies suggest that the posterior cerebellum contributes to the prediction of action sequences as well as the detection of social violations. In this analysis, we explored the effective connectivity of the cerebellum with the cerebrum in processing action sequences implying person traits and group stereotypes, across four studies with 102 healthy participants, using dynamic causal modeling (DCM). A first model aimed to explore the functional cerebello-cerebral connectivity when learning trait/stereotype-implying action sequences. We found many significant closed loops between mentalizing areas of the posterior cerebellum and the cerebrum including the temporo-parietal junction and medial prefrontal cortex. Within the cerebrum, we found significant connectivity between the right TPJ and the mPFC, and between the bilateral TPJ. A second model aimed to investigate cerebello-cerebral connectivity when conflicting social information arises during trait/stereotype-implying action sequences. We found an abundance of significant closed loops between the posterior cerebellum and cerebral mentalizing (e.g., dorsal mPFC) and executive control networks (e.g., lateral prefrontal cortices). Additional closed loops in the cerebrum were found within the mentalizing and executive control networks, as well as some crossover closed loops between these networks. The current results confirm prior research on effective connectivity linking the cerebellum with mentalizing areas in the cerebrum for identifying and predicting social sequences, and extend it to executive areas in the cerebrum for detecting violations of social behaviors. The many closed loops between the cerebellum and cerebrum emphasize the important functional role of the cerebellum in supporting mentalizing about traits and stereotypes.

ID: 172

Effective cerebello-cerebral connectivity during implicit and explicit social belief sequence learning using dynamic causal modelling

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Earlier fMRI studies demonstrated the involvement of mentalizing regions in the posterior cerebellum and several cerebral neocortical areas (e.g., temporo-parietal junction, precuneus, temporal pole) during implicit and explicit sequence learning of protagonists' true and false beliefs using the belief Serial Reaction Time task However, little is known about the neural interaction between these cerebellar and cortical regions in the mentalizing process. The current study explored their effective connectivity using dynamic causal modelling (DCM). In line with our hypotheses, DCM analyses for both implicit and explicit belief sequence learning revealed that the posterior cerebellar Crus I & II were effectively connected via closed loops (bidirectional) to cerebral mentalizing areas, especially to the bilateral temporo-parietal junctions. Furthermore, there were more closed loops during implicit, rather than explicit, learning, which may indicate that the posterior cerebellum may be involved more in implicitly detecting and automatizing sequential social information. Given the many identified closed loops, our study supports the general view that the posterior cerebellum receives incoming signals from critical mentalizing areas in the cerebrum to identify sequences of social actions, and then sends signals back to the same cortical mentalizing areas to prepare or adjust one´s own social actions.

Investigating the Role of Theory of Mind on the Moment-To-Moment Processing of Dramatic Irony Scenes in Film

Cynthia Cabañas[1], Atsushi Senju[1,2], Tim J Smith[1]

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Similar to real life, watching cinema involves interpreting characters' mental states through Theory of Mind (ToM). To investigate how ToM inferences influence the way viewers attend to and process the film, we focused on dramatic irony scenes, where the audience knows something that a character does not. We hypothesized that the salient divergence of knowledge would prompt spectators to infer the characters' mental states, similar to prototypical false-belief scenarios. In a spontaneous mental state attribution study (Study 1), we provided critical information that the characters did not possess to some viewers (dramatic irony/DI group) and not to others (control group, who are as 'ignorant' as characters), thereby creating differences in the divergence between characters' knowledge and the real event, allowing us to compare how viewers process the same scenes depending on their ToM representations. We found that participants in the DI group used more cognitive mental state words to describe the events than the control, suggesting that the former spontaneously inferred more the character's epistemic states. For Study 2, we hypothesized that DI would engage ToM during film-viewing, prompting deeper and resource-demanding cognitive processing. Combining eye tracking with a self-paced film viewing task we examined: (a) reaction times when processing the critical scenes frame by frame, (b) pupil dilation as an indirect marker of processing load and (c) the analysis of spatio-temporal distribution of overt attention, to examine how participants extract information about characters' mental states. Future studies will use fMRI to further elucidate moment-to-moment ToM processing in these scenes.

Motherhood and social cognition based on child and adult faces

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Caring for another human being involves understanding their feelings, thoughts and needs. It is, therefore, not surprising that studies show motherhood interacting with various aspects of social cognition. Using functional magnetic resonance imaging, this project investigates neural and behavioral differences in facial affect recognition and theory of mind (ToM) between mothers and non-mothers. Within three experiments, both child and adult stimuli were used to inspect whether differences between mothers and non-mothers are limited to understanding children or extend to adults. Mothers needed more time to recognise emotions in child faces with the same accuracy as non-mothers, although they showed no differences in performance in a matched control task. During ToM, mothers showed increased activation in the bilateral posterior cingulate extending into the precunei and insulae in response to both adult and child faces. For the facial affect recognition task, mothers showed increased neural activation in the precuneus in response to child compared to adult stimuli. The results indicate that mothers and non-mothers differ in all observed aspects of social cognition. These differences are not confined to the social understanding of children but extend to other adults. The insights of this project can serve as a starting point for additional research, including branching out to parents other than primary-care mothers.

Structural and functional alterations patterns in the cerebellum underlies social cognition deficits in the Behavioral Variant of Frontotemporal Dementia: evidence from a behavioural and MRI study

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Background and aims. The Behavioral variant of FTD (bvFTD) is a progressive neurodegenerative disorder characterized by prevalent social behavior deficits (Christidi et al., 2018). Although consensus has been reached on the cerebellar role in social cognition (SC) (Van Overwalle et al., 2020), its specific contribution to social impairment of bvFTD has never been specifically investigated. Aim of this study was to assess the pattern of cerebello-cerebral functional connectivity (FC) changes in the bvFTD and their potential association with social symptoms observed in patients. Methods and Materials. To this aim, 15 patients with bvFTD and 34 healthy subjects (HS) were enrolled. SC performances were tested in both groups by using an ad-hoc SC battery and all participants underwent an MRI scanning at 3.0T including T1-weighted and resting-state functional MRI scans. A one-way ANOVA was used to

compare SC performances between bvFTD patients and HS. A voxel-based morphometry was used to assess cerebellar grey matter (GM) changes and a seed-based analysis was performed to test cerebello-cerebral FC patterns between regions of reduced cerebellar GM and the whole brain. Correlations between SC scores and FC patterns were tested. Results. Compared to HS, bvFTD patients showed a significant cerebellar GM loss specifically involving the cerebellar Crus I-II. Additionally, FC changes were found between these cerebellar regions and cerebral regions of the social brain. Interestingly, patterns of cerebello-cerebral FC changes correlated with altered SC performances of patients. Conclusion. The present findings suggest that the specific cerebello-cerebral FC changes may underlie specific social alterations in bvFTD.

POSTER PRESENTATIONS

Keywords: social navigation; expectation violation; social sequence learning; social interaction; mentalizing; posterior cerebellum; goal-directed behavior; predictive brain

Mind your step: social cerebellum in interactive navigation

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BACKGROUND AND AIM: The cerebellum contributes to dynamic social cognition by building representations and predictions about sequences in which social interactions typically take place. However, the extent to which violations of prior social expectations during human interaction activate the cerebellum remains largely unknown. The present study examined inconsistent actions, which violate the expectations of desired goal outcomes, by using a social navigation paradigm.

METHODS: Participants (n = 25) were required to observe and memorize the movements in a trajectory of an agent through a grid, picking up a gift in the middle of the trajectory and walking toward the recipient who either liked this gift (consistent) or not (inconsistent). As a nonsocial control condition, using the same grid structure and trajectory, a pen was transported on an assembly line to be filled with ink and covered with a pen cap that had the same (consistent) or another (inconsistent) color. As a social non-sequencing control condition, participants had only to observe the trajectory.

RESULTS: Results revealed that expectation violations in social (vs. non-social) sequencing were associated with activation in the posterior cerebellum (Crus 1/2), together with other key cortical mentalizing regions. In contrast, non-social (vs. social) sequencing recruited cerebellar lobules IV-V and key cortical regions of the action observation network and the navigation-related parahippocampal gyrus.

CONCLUSIONS: The findings provide further evidence of posterior cerebellar involvement in signaling inconsistencies in human social mentalizing during goal-directed navigation, which take precedence over its function of merely representing the sequences in social navigation.

Keywords: Distraction, Driving, Aging, EEG

Driving behavior und event-related potentials (ERP) under visual distraction: A driving simulator study with young, middle-aged, and older drivers

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Introduction: Distraction is one of the greatest risk factors for road crashes. In order to adequately deal with distraction, inhibition is required - an executive function, that is subject to age-related changes. The present study investigated how visual distraction affects the braking behavior of different age groups and their ability to focus on or withdraw their attention from potentially distracting stimuli in critical driving situations.

Methods: 72 subjects from four age groups completed a simulated driving task that required occasional braking responses under visual distraction. In certain experimental conditions, subjects had to respond to or inhibit a response to the distracting stimuli. Behavioral and neurophysiological data (EEG) measured while driving were assessed.

Results: In the two older groups, even in a simple task condition braking response times increased under visual distraction. In more complex task conditions this effect occurred in the middle-aged group as well. With increasing age, braking error rates, especially the missing of braking responses in favor of the response to the distracting stimuli, increased. This effect was associated with a reduced P3b component in the event-related potentials and pronounced in conditions, where the response to distraction stimuli had to be inhibited.

Discussion: Visual distraction stimuli increase braking response times and braking error rates. This is particularly true for complex traffic situations with a high risk of critical situations, for distraction stimuli that require a response under certain circumstances, and for older drivers. Neurophysiological data indicate an unfavorable allocation of mental resources with increasing age.

Unbalanced functional connectivity at rest affects the ERP correlates of affective prediction in high Intolerance of Uncertainty individuals: a high density EEG investigation.

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In a previous study (Del Popolo Cristaldi et al., 2021) we outlined the link between Intolerance of Uncertainty (IU) and the neural correlates of affective predictions, as constructed by the brain (generation stage) to predict and prepare to relevant stimuli (implementation stage), and to update affective predictive models according to incoming stimuli (updating stage). In this study we further explored whether the brain's functional organization at rest can influence the neural activity elicited within an emotional S1-S2 paradigm, as a function of IU and uncertainty of S1-S2 contingencies. We computed resting state functional connectivity (RS-FC) from a 3-min resting period recorded with high density EEG, and we tested whether RS graph theory nodal measures (i.e., strength, clustering coefficient, betweenness centrality) predicted in-task ERP modulation in high- vs. low-IU individuals. We found that RS-FC differently predicted in-task ERPs within all the stages as a function of IU. High-IU individuals showed altered RS-FC patterns within both domain-specific (i.e., right superior temporal sulcus) and domain-general regions (i.e., left temporoparietal junction, right orbitofrontal cortex and right temporal pole), which predicted a less efficient modulation of in-task ERPs during the generation and updating stages. This is presumably ascribable to an unbalancing between neural synchronization and integration within these regions, which may disrupt the exchange of information between top-down and bottom-up pathways. This altered RS-FC pattern may in turn subtend the construction of less efficient affective predictions and a reduced ability to deal with contextual uncertainty in individuals high in IU.

Bodily awareness in depersonalization-derealization disorder

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Depersonalization-derealization disorder (DDD) is a dissociative disorder encompassing pronounced disconnections from the self, including feelings of disembodiment, and disconnections from external reality. As DDD is inherently tied to a detachment from the body, dance and movement could provide an innovative treatment approach. To this end, two dance-based interventions were designed to promote either bodily awareness (Body Awareness, BA, Task) or to enhance the saliency of bodily signals (Dance Exercise, DE, Task). DDD patients (n = 31) and clinically healthy controls (n = 29) participated online in two, individualized, two-week testing periods. Depersonalization symptom severity (CDS), interoceptive awareness (MAIA-II) and mindfulness (FFMQ) were measured before, midway, and after each intervention. At baseline, patients exhibited lower levels of interoceptive awareness (g = 0.79) and mindfulness (g = 1.16) as compared to controls. After treatment, both tasks significantly reduced depersonalization symptoms in the patient group (BA: $\eta p2$ = .25; DE: $\eta p2$ = .28), but the effectiveness of each task varied between groups and across individuals. While the DE Task increased mindfulness in the patient group ($\eta p2$ = .23) more than the BA task, controls showed the opposite pattern ($\eta p2$ = .20). Significant negative repeated measures correlations also revealed that reductions in depersonalization symptom severity were tied with improvements in interoceptive awareness and mindfulness in the patient group. Dance provides a potentially powerful and bespoke tool to reduce dissociative symptoms in DDD by enhancing both the saliency of bodily signals and developing patient's abilities to verbalise and focus on bodily sensations.

The effects of mindfulness-based stress reduction on the association between autonomic interoceptive signals and emotion regulation selection

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Emotion regulation plays an important role in psychological adjustment.

Data highlights the importance the ability to use different emotion regulation strategies in accordance with changing situational demands is predictive of emotion regulation success.

One mechanism that might support the ability to use emotion regulation strategies in a flexible manner is bodily-based physiological processes. To date, little is known about the ability of internal bodily feedback to guide an adaptive choice between different emotion regulation strategies, depending on the specific demands of the situation.

Interestingly, the interoception ability that hypothesized to guide the adaptive and choice between ER strategies is one of the central features of mindfulness practice. Moreover, recent findings from our lab demonstrated increased Emotion Regulation Flexibility (ERF) following 9 weeks MBSR course.

Therefore, the aim of the current research was to study the relation between increased interoception abilities following mindfulness practice and emotion regulation selection. To that end, a multi-dimensional approach was taken in order to evaluate interoception levels before and after a 9 weeks MBSR course

We will report findings from an ongoing study that will hopefully promote our understanding regard to the possible role of increased interoception abilities following mindfulness practice in improving emotion regulation flexibility and discussed the possible implications to health and well-being.

ID: 155

Positive cognitive reappraisal is beneficial for women's but not for men's IGT decision-making

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Real-life decision-making involves a balance between emotion and cognition, a process that is mirrored in the Iowa GamblingTask (IGT). Previous studies suggest that negative emotion affects IGT performance, and that this effect may be moderated by gender. In the current study, we instructed the use of a strategy for ameliorating negative emotions induced by negative images while men and women solved the IGT. To do this, we asked 38 men and 38 women to either only look at negative images (non-reappraisal group) or to use positive cognitive reappraisal when facing these negative images (reappraisal group) to ameliorate the negative emotion associated with them while trying to solve the IGT. Both men and women in the reappraisal group successfully used positive reappraisal to decrease their negative emotion compared to the control, non-reappraisal group. Critically, we observed that women performed better in the reappraisal group compared with the non-reappraisal group, in the second half of the task (performance phase). Conversely, men performed worse in the reappraisal group compared to the non-reappraisal group in the second half of the task (performance phase). Finally, a multi-group analysis revealed a gender moderation of the direct and indirect effects of positive reappraisal on IGT performance, indicating that reappraisal benefited women's IGT performance through the regulation of negative emotion. Conversely, for men, the decrease of negative emotion through reappraisal did not impact IGT performance. Our results demonstrate that while positive reappraisal helps to ameliorate negative emotions regardless of gender, positive reappraisal benefits women's decision-making, and impairs men's.

ID: 159

All that meets the eye: The contribution of reward processing and pupil mimicry on pupillary reactions to facial trustworthiness

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The present work investigates pupillary reactions induced by exposure to faces with different levels of trustworthiness. Participants' (N = 69) pupillary changes were recorded while they viewed white male faces with a neutral expression varying on facial trustworthiness. Results suggest that reward processing and pupil mimicry are relevant mechanisms driving participants' pupil reactions. However, when including both factors in one statistical model, pupil mimicry seems to be a stronger predictor than reward processing of participants' pupil dilation. Results are discussed in light of pupillometry evidence.

ID: 171

Early Gaze direction processing: insights from ERP decoding

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The current pandemic situation and the use of the masks have shown the importance of eyes in social communication. Distinguishing the direction of another person's eye gaze is extremely important in everyday social interaction, as it provides critical information about people's attention and, therefore, intentions. The temporal dynamics of gaze processing has been investigated using event-related potentials (ERPs) recorded with electroencephalography (EEG). However, how fast our brain distinguishes gaze direction remains unclear. To solve this question, the present study aimed to investigate the latency of gaze direction, using an ERP decoding approach, based on the combination of a support vector machine and error-correcting output codes. We recorded EEG in 40 young healthy subjects performing gaze detection task. The task presented 3D realistic faces with five different head and gaze orientations each: 30, 15 degrees to the left or right, and 0 degrees. While the classical ERP analyses did not show clear gaze direction effects, ERP decoding analyses revealed that discrimination of gaze direction, irrespective of head orientation, started at 160 ms and reached its peak at around 500 ms after stimulus onset. These findings suggest that as early as 160 ms our brain establishes the decoding of gaze direction.

Neural correlates of authentic vs. hubristic pride and shame in social context.

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The neural underpinnings of social emotions (pride/shame) are scarce. Furthermore, no studies have explored yet the possible neural dissimilarities between the two facets of pride (authentic vs. hubristic). The present study aims to contribute in this regard by using Event-Related brain Potentials to examine the neural processes underlying both types of pride and corresponding situations of shame. A dot-estimation task was adapted to explore pride/shame elicited in a simulated social context where two different groups were prompted with an authentic/hubristic induction through instructions along the experiment.

Both authentic/hubristic pride showed an early negativity apparently originated in medial parietal regions (precuneus) and possibly reflecting social comparison processes in successful trials. For both types of pride, this negativity was followed by a late positivity probably originated in medial frontal regions, presumably reflecting the verification of singularly successful trials. Only in hubristic pride this late positivity remained in a long-lasting window (900-1100ms) suggesting further reappraisal processes and directed attention to the emotional situation.

In turn, both authentic/hubristic shame elicited an early negativity apparently originated in the cuneus, probably related to mental imagery of the social situation. It was followed by a late positivity probably originated in middle temporal regions and reflecting social comparison and memory re-encoding in unsuccessful trials. Only authentic shame prompted a later long-lasting positivity (1000-1150 ms) suggesting a down-regulation or reappraisal strategy possibly originated in parietal regions. The present results provide a first dynamic distinction of neural mechanisms underlying authentic/hubristic facets of pride/shame.

Validating an audiovisual paradigm to study the emotional egocentricity bias

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The ability to judge another person's emotional state can be biased by one's own emotional state, which becomes apparent when emotional states are incongruent to each other. Such an emotional egocentricity bias (EEB) might indicate reduced self-other distinction and hinder one's empathic understanding of others' emotions. Prior work has introduced both visuotactile and audiovisual paradigms to study the EEB. Here, we employed an audiovisual paradigm to examine whether the EEB can be considered a trait or state and whether an electrophysiological EEB effect can be found. In a series of studies conducted both online and in the lab, we found a significant, but small EEB. The EEB failed to correlate significantly within participants across time-points (r = .3) and did not correlate with empathy scales, questioning that the EEB in this paradigm shows trait characteristics. On the electrophysiological level, a cluster-size corrected permutation test did not show any neural EEB effect in the time-frequency domain. Given the rather small and variable effect sizes of the EEB, the current audiovisual paradigm might not be optimally suited to study the EEB on a behavioral and neural level.

Neural correlates underlying social-cue induced value change

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As social beings, human behavior and cognition are fundamentally shaped by information provided by peers, making human subjective value for rewards prone to be manipulated by perceived social information. Even subtle non-verbal social information, such as other's eye gazes, can influence value assignment, such as food value. In this study, we investigate the neural underpinnings of how gaze-cues modify participants' food value by means of functional magnetic resonance imaging (fMRI). During the gaze-cueing task, food items were repeatedly presented either while others looked at them or while they were ignored by others. We determined participants' food values by assessing their willingness to pay (WTP) before and after a standard gaze-cueing training. Results revealed that participants were willing to pay significantly more for food items that were attended by others compared to the unattended food items. Neural data showed that differences in subjective values between the two conditions were accompanied by enhanced activity in the inferior frontal gyrus, middle temporal gyrus, and caudate after food items were attended. Furthermore, the functional connectivity between the caudate and the angular gyrus precisely predicted the individual differences in the preference shift. Our results unveil the key neural mechanism underlying the influence of social cues on subjective value of food and highlight the crucial role of social context in shaping subjective value for food rewards in human.

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No Influence of Threat Uncertainty on Fear Generalization (N = 88)

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Both overgeneralization of fear responses and perceived uncertainty about future outcomes have been suggested as risk factors for anxiety disorders. This far, little is known regarding the influence of threat uncertainty on fear generalization (FG). In this study, we investigated whether different levels of threat uncertainty influence FG. To this aim, three groups of healthy participants underwent a differential threat conditioning protocol followed by a generalization test. All groups learned to associate one (CS+) of two female faces with a female scream (US) while the other face (CS-) was never paired with the scream. Threat uncertainty was manipulated via the reinforcement schedule meaning that for one group the CS-US contingency was 80% (low uncertainty), for the second group it was 60% (moderate uncertainty), and for the third group 40% (high uncertainty). In the generalization test, all groups saw CS+ and CS- again as well as four morphs that varied in similarity with the CS+ in steps of 20%. Results demonstrated successful conditioning in all measures except for the steady-state visual evoked potentials. There was a descriptive difference in skin conductance response for CS+ between high and low uncertainty groups suggesting stronger defensive physiological arousal for the high uncertainty group, but the lowest US-expectancy. During the generalization test, we found no effect of threat uncertainty on FG in any of the measures. This study provides evidence that solely threat uncertainty does not act as a modulating factor for FG.

ID: 197

Electrophysiological dynamics of self-identity across time

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Research on self-identity suggests that the self is configured in a unique mental representation updated across the lifespan in autobiographical memory. Spatio-temporal brain dynamics on this cognitive representation are poorly understood. A previous Event-Related brain Potential (ERP) study revealed early (N170-N250) and late (P3-LPC) waveforms modulations tracking the temporal processing of global face configuration, familiarity, and access to autobiographical contents. In turn, neuroimaging studies revealed that such processes encompass face-specific regions (fusiform gyrus -FG-), medial prefrontal cortex (mPFC), parahippocampus (paraHC), and posterior cingulate cortex/precuneus (PCC/PC) tracing self-identity into autobiographical memory across time. This study used a spatio-temporal approach, analyzing ERP neural source analysis using a data-driven, beamforming technique. Face recognition was requested in two separate tasks: identity (self, close friend, unknown) and life stages (childhood, adolescence, adulthood). Cluster-permutation tests revealed, at mid latencies (250-300 ms), higher activation in the

dl/dmPFCm, ACC, and ATL to self-face recognition compared to close-friend faces. Self-faces activated the mPFC and TPJ compared to unfamiliar faces. Moreover, frontotemporal areas (dlPFC and FG) appeared to represent an updated version of self-identity, and only posterior regions (MTG and FG) represent distant self-identity. Subsequently (300-600 ms), the mPFC discriminates self-identity vs. close-familiar and unknown based on self-relevant meaning. Significant effects in the mPFC were found for self-identity, distinguishing between adulthood, adolescence, and childhood. These findings suggest that the mPFC maintains an updated representation of self-identity based on actual rewarding value. Further, the dlPFC, FG, MTG, paraHC, and PCC were sensitive to different life stages of self-identity duringaccess autobiographical memory.

ID: 352

Take it with a grain of positivity: Anger elicitation and regulation in neurologically healthy individuals

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Emotion elicitation and regulation has important practical implications for rehabilitation in clinical populations. However, many studies have investigated multiple emotions, instead of focusing on one, such as anger. Anger outbursts can negatively affect both individuals and their loved ones, especially in neurological populations (e.g., those with acquired brain injuries; ABI). In the current study, we investigated the usefulness of (1) an autobiographical recall task to elicit anger; and (2) two emotion regulation techniques. Fifty neurologically healthy individuals were asked to describe a series of personal events in relation to five attachment relationships (family, friend, partner, stranger, and other). After each event, they either regulated their anger using reappraisal (reframing the event positively), or distraction (drawing a happy memory). Before and after deploying each technique, participants completed a self-report measure of emotion intensity. The results suggested that the autobiographical recall task elicited the highest intensity of anger when recalling events relating to a stranger, partner, family, friend, and other, respectively. Furthermore, both reappraisal and distraction reduced the intensity of anger, with distraction appearing more effective than reappraisal. These findings have crucial implications for anger management interventions aimed at clinical populations. Firstly, they suggest a simple and effective anger elicitation tool, especially in relation to specific attachment relationships. Secondly, they suggest two practical techniques to regulate anger, which may benefit the quality of life of patients and their loved ones. Future research could investigate the autobiographical recall task and emotion regulation strategies in a clinical population such as ABI.

ID: 203

The causal role of affect sharing in observational fear learning: A preregistered fMRI study using hypnotic suggestions

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The aim of this preregistered fMRI study was to assess the role of affect sharing, an important aspect of empathy, in observational fear learning. N=55 psychology students pre-screened for above-average hypnotizability completed an observational Pavlovian fear conditioning paradigm. In the learning stage, they watched another person – the demonstrator – responding with distress when receiving electric shocks to a color cue (conditioned stimulus; CS+; a different color served as CS-). In the subsequent test stage, an increased skin conductance response (SCR) to the CS+ presented in the absence of the demonstrator indexed observational fear learning. Each participant completed this paradigm under two different hypnotic suggestions, which were administered to induce high or low affect sharing with the demonstrator in the learning stage, following a counterbalanced within-subject design. Results of fMRI and eye-tracking are currently being analyzed. N=44 participants provided technically valid SCR data. In the learning stage, high affect sharing resulted in stronger unconditioned SCR and higher self-reported unpleasantness while witnessing the demonstrator's distress. Participants showed a conditioned fear response (CR) both in the learning and in the test stage, with no significant differences between high and low affect sharing. However, the magnitude of the CR in the test stage declined during later compared to earlier trials under low affect sharing, but remained stable under high affect sharing. These findings demonstrate that high affect sharing may contribute to slower extinction of observational fear learning, and thus advance our understanding of the role of empathy, and more generally emotion, in social observational learning.

ID: 205

A neuroscience approach to prison experience: on the influence of prison on the sense of agency and empathy for pain among inmates.

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At the end of the prison sentence, former inmates are expected to reintegrate the social system without committing further offences. However, past research and criminological data highlight that prison sentences are not an effective mean for preventing recidivism potentially demonstrating the negative influence of prison on people's future decisions to act legally or against the law.

I will present a study which aims to investigate, with a social neuroscience approach, the potential influence of the coercive and restrictive nature of prison on two neurocognitive processes related to decision-making among inmates: The sense of agency and empathy for pain. While previous results showed that prison can affect specific aspects of executive and emotional functioning among inmates and that coercive environments such as the military may reduce one's own sense of agency, there is currently no study that has investigated the influence of prison on the neural mechanisms underlying sense of agency and empathy for pain. Our first results appear to corroborate our hypotheses that a closed detention regime, which is characterized by a permanent security regime, leads to an alteration of sense of agency and of neural processing of the pain of others. Although these results should be treated with caution as they consisted in only one group of inmates, they provide insights into how restrictions in action choices related to prison may affect cognitive processes directly associated with social behaviour and freedom to take control of one's life.

ID: 209

Interoception and self-perception in Schizophrenia patients

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The current criteria and diagnosis, of psychiatric conditions is based on symptoms rather than biological mechanisms. Science is trying to move forward towards a mechanism-based classification, which would likely improve patient care and treatment. It has been suggested that people with schizophrenia (SZ) may have altered interoceptive mechanisms and self-other distinction. In order to assess these mechanisms in SZ we designed a study including behavioral, electrophysiological and neuroimaging tasks. An easy way to study bodily self-perception is to compare self-touch with touch from others: both provide comparable stimulation of the skin, but the brain must be able to distinguish between the two types of touch. Interoception is tested using a heartbeat detection task and questionnaires. Preliminary results show some alterations in interoceptive and self domains with respect to neurotypical volunteers. A disturbance of these processes can have far-reaching consequences for the establishment of an adequate bodily self-perception which may lead also to alterations in allostasis and in higher order cognitive domains. This study may increase our understanding of self-perception and body awareness in SZ. In the long run, the results may enable the development of new treatment strategies.

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Neglect in temporal domain: Amelioration following a prismatic adaptation treatment and implications in everyday life. A single case study

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In time bisection, neglect patients fail to process the first/left part of time representation (Mental-Time-Line-MTL) resulting in a rightward shift of the interval midpoint.

Here we study the time deficit, its ecological impact and the effects of a rehabilitation treatment inducing a leftward shift of spatial attention by using prismatic adaptation (PA), in an outpatient with neglect (LL)

LL performed a time bisection task, an ad hoc lifespan task with autobiographical events and a semi-structured interview to explore time perception in everyday life, before and after 10 sessions of PA.

PA treatment, rebalancing the spatial attention distribution, reduced the length of reproduced intervals, improved the allocation of autobiographical past and future events and reduced the feeling "to be forward in time". Thus, PA-treatment is suggested as a powerful instrument for the reduction of time deficit and its ecological impact in neglect patients.

Frontal alpha asymmetry and frontal theta power in response to adult faces varying in familiarity, gender and displayed emotion: a pilot EEG study with 6-month-olds

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Relative left frontal brain activation is associated with approach behaviours, while relative right frontal activation indicates withdrawal - a phenomenon that has been observed across development, including infancy. Additionally, EEG power in the theta frequency band over the frontal brain regions in infants has been linked to learning. In our pilot study, we aimed to characterize infant affective and cognitive processing of adult faces using these two neural markers.

Six-month-olds were presented with images depicting various faces: their mother smiling, an unfamiliar women smiling, an unfamiliar woman frowning, an unfamiliar women with averted gaze, and an unfamiliar man with a neutral expression (within-participant); we also included non-social cartoon pictures presented between the face pictures.

We computed frontal asymmetry scores by subtracting natural logarithms of EEG power in the alpha band (5-7 Hz) in the left frontal regions from the right frontal regions: frontal theta power index was calculated as the ratio of frontal theta (3-5 Hz) power during face presentation relative to the non-social cartoon presentation.

For each condition, between n = 9 and n = 14 participants provided usable data. We found evidence of increased learning (as indicated by increased frontal theta) while viewing unfamiliar frowning female faces. No clear patterns of frontal alpha asymmetry emerged from our data. Our results add to the studies showing that negative expressions may be particularly captivating for infants (likely because of their novelty), and suggest that their novelty may drive increased learning. Given the relatively small sample, the results would benefit from replication studies.

Voluntary Control of the Amygdala Activity using Real-Time functional MRI-based Naturalistic Adaptive Neurofeedback

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Emotion dysregulation is triggered by impaired cortico-limbic functioning. Specifically, the amygdala exhibits abnormal connectivity in affective disorders like depression. Voluntary regulation of the amygdala activity is feasible using real-time fMRI-based neurofeedback. We applied a novel naturalistic adaptive feedback modality that uses dynamic happy and fearful human facial stimuli whose intensity gradually changes depending on the participant's ongoing amygdala activity. In contrast to the conventional protocols, such innovative neurofeedback is motivating and socially rewarding.

We tested the efficacy of this approach in healthy participants (N=32) who performed four neurofeedback runs in two groups: happy-up, and fear-down. Participants in the happy-up group (N=16) were instructed to increase the happiness of the ambiguous face stimulus to upregulate amygdala activity, and the fear-down group (N=16) was instructed to reduce the fearful facial expression by downregulating their amygdala. MRI measurements were conducted on a 3T Philips Achieva scanner, and continuous feedback was calculated using OpenNFT. By following similar strategies, the ongoing clinical study includes patients (N=12 at the time of submission) diagnosed with unipolar depression who were trained to upregulate their hypoactive amygdala to improve anhedonia symptoms in happy-up condition and downregulate hyperactivity to reduce anxiety in fear-down condition over eight neurofeedback runs.

Preliminary results of the pilot study suggested a significant decrease in amygdala activity in response to fearful faces and a comparative increase in response to happy faces in healthy participants. Clinical findings in patients will further reveal the potential of neurofeedback as a noninvasive therapeutic modality to target neural deficits in depression.

Does an empty Stomach influence the rewarding Value of Compliments?

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Being hungry strongly motivates food search, and hunger even has the potential to override other motivators such as thirst and anxiety. Rats and fruit flies even prioritise feeding over sexual interaction. It is not known, however, whether and how hunger affects the motivation and response to non-food rewards in humans. Therefore, this pre-registered neuroimaging study investigated how hunger influences the processing and experience of social recognition.

Sixty-eight volunteers were tested twice: once being hungry and once after having eaten a meal. They rated how rewarding they experienced neutral self-referential statements and compliments while their brain activation was measured during 3T functional imaging (fMRI). Imaging data were analysed applying a region-of-interest (ROI) approach in reward areas.

Compliments were rated as more rewarding, and activated a ROI in ventromedial prefrontal cortex (vmPFC) more strongly than neutral statements. Nutritional state had no impact on subjective experience, but a ROI in the right ventral striatum was activated more strongly during all types of statements when being hungry than when having eaten.

The data indicate that vmPFC is more sensitive to the content of statements than ventral striatum, and that vmPFC is not affected by nutritional state. Stronger ventral striatum activation when being hungry suggests enhanced value of all self-related statements. This might be caused by increased attention towards oneself when the stomach is empty.

Endocannabinoid and neuroendocrine contributions to fear learning in humans

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Fear learning is an important process that is essential for our survival. Impairments in this implicit form of emotion regulation is associated with several stress-related psychiatric disorders. Here, our goal was to determine the contributions of canonical stress systems, i.e., neuroendocrine and endocannabinoid systems, to fear learning in a population with histories of chronic stress exposure.

In a 2x2 factorial design, adult participants (total n=100) with or without histories of childhood trauma or substance use disorders completed a laboratory session to assess fear conditioning and extinction, and had blood samples collected to quantify peripheral levels of endocannabinoids and cortisol.

Overall, 2-arachidonoyl glycerol (2AG), an endocannabinoid important for the termination of the stress response, was significantly negatively associated with self-reported anxiety and difficulties in emotion regulation, indicating that individuals with lower 2AG levels tend to be more anxious and have greater impairments in emotion regulation.

Although there were no main effects of group on different aspects of fear learning, baseline levels of cortisol and endocannabinoids influenced fear learning in the sample overall. Specifically, higher baseline levels of cortisol were associated with better acquisition of conditioned fear. Furthermore, baseline 2AG levels were related to the early extinction of conditioned fear such that higher levels of 2AG were coupled with greater distinction between the reinforced conditioned stimulus (CS+) and the non-reinforced conditioned stimulus (CS-).

While additional analyses are ongoing, these results provide valuable insight into the neurobiology of fear learning and highlight potential molecular targets that could have therapeutic potential.

Lonely in the Dark: Trauma Memory and sex-specific Dysregulation of Amygdala Reactivity to Fear Signals

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Loneliness exacerbates psychological distress and increases the risk of psychopathology after trauma exposure. However, it is still unclear whether a lack of social connectedness affects trauma-related intrusions and the neural processing of fear signals. Moreover, it is uncertain, whether loneliness plays a different role in women and men. A prestratification strategy is used and n = 47 (n = 20 women) healthy lonely individuals and n = 35 controls (n = 18 women) are recruited. Participants are exposed to an experimental trauma and evoked intrusive thoughts in daily life are monitored for three consecutive days. Functional magnetic resonance imaging is used to assess neural habituation to fearful faces and fear learning (conditioning and extinction) prior to trauma exposure. The results reveal a significant interaction between loneliness and sex such that loneliness is associated with more intrusions in men, but not in women. A similar pattern emerges at the neural level, with both reduced amygdala habituation to repeated fearful faces and amygdala hyperreactivity during the conditioning of fear signals in lonely men. The findings indicate

that loneliness may confer vulnerability to intrusive memories after trauma exposure in healthy men and that this phenotype relates to altered limbic processing of fear signals.

ID: 245

Exogenous estradiol and oxytocin modulate sex differences in hippocampal reactivity and episodic memory

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Considerable evidence supports sex differences in autobiographical and episodic memory which may translate to heightened vulnerability to stress- and trauma-related disorders in women. The hormones estradiol and oxytocin both affect episodic memory, but possible sex-specific effects and hormonal interactions have not been systemically tested in humans. We conducted a randomized, placebo-controlled, parallel-group functional magnetic resonance imaging (fMRI) study involving healthy women (n = 111) and men (n = 115). Participants were scanned under four experimental conditions: 1. estradiol gel (2 mg) and intranasal oxytocin (24 IU), 2. placebo gel and intranasal oxytocin, 3. estradiol gel and placebo spray, 4. placebo gel and placebo spray. During fMRI, participants viewed positive, neutral and negative scenes. A surprise recognition task three days later was used to classify encoding trials as remembered or forgotten. Under placebo, women showed a significantly better recognition memory and increased hippocampus responses to subsequently remembered items independent of the emotional valence compared to men. Separate treatments with either estradiol or oxytocin significantly diminished this mnemonic and hippocampal sex difference, whereas the combined treatment produced no significant effect. Collectively, our results suggest that estradiol and oxytocin play a crucial role in modulating sex differences in episodic memory. Furthermore, possible antagonistic interactions between estradiol and oxytocin could explain previously observed opposing hormonal effects in women and men. Thus, future clinical trials with oxytocin need to control for interactions with gonadal steroids such as estradiol.

ID: 251

Lonely heart in the wild: reduced real-life heart rate variability and increased negative appraisals in lonely individuals

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Due to its association with increased cardiovascular risk, a lot of focus has been put on examining physiological mechanisms underlying loneliness. It has been shown that heart rate variability (HRV) may serve as an index of reduced parasympathetic regulation and of the dynamic interplay between the medial prefrontal cortex and amygdala. Moreover, decreased HRV has been observed in patients with conditions characterized by reduced social functioning and aberrant threat processing. While initial evidence for the associations between loneliness, reduced HRV, and the increased social threat has been previously demonstrated, most of the findings come from laboratory studies examining short-term cardiac activity at rest. Thus, the current study examined the relationship between real-life HRV markers and appraisals of everyday social encounters in lonely (LI) and non-lonely individuals (NLI).

Seventy LI (37F, 24.2±3.9 years old) and sixty NLI (29F, 24.1±4.5 years old) completed a week-long experience sampling study. During each prompt participants were asked about their affective states, characteristics of current activity and company, and appraisals of their current situation. Furthermore, participants' physiological activity was monitored with the Empatica E4 wearable device.

Results revealed that LI experienced more negative and less positive affect. Furthermore, less positive and more stressful and threatening appraisals of both being accompanied by other people and being alone were found in LI compared to NLI. Decreased HRV was also found in LI. The presented findings corroborate the notion that loneliness can affect real-life physiological functioning and elevate social threat perception.

ID: 257

Neurophysiological correlates associated with processing of social interactions in young adults

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Multiple recent studies examined the sociocognitive mechanisms and neural correlates associated with the processing of social interactions. Such stimuli were shown to preferentially grab attention and produce more widespread neural activity than individual actions of two agents. It is believed that loneliness may generate an increased focus on one's self-preservation and, in consequence, disturb social information processing. The aim of the presented study was to examine the relationship between loneliness and automatic and volitional mechanisms associated with the processing of social interactions in a group of participants from the general population (n=80 (46 F) 25,45+/-4,54 y.o.). During the study, participants were asked to watch three-second animations depicting two point-light agents that have been taken from Social Perception and Interaction Database (Okruszek & Chrustowicz, 2020). The vignettes depicted either neutral social interactions or altercations between the agents (28 animations from each category). Furthermore, the preceding cues informed participants whether they should either just observe stimuli or reappraise the altercations as less negative. Both explicit (behavioral ratings) and implicit (EEG event-related potentials) markers of the response to the stimuli were collected during the whole task. Altercations were rated as more arousing and negative compared to neutral social interactions. They have also produced elevated early and late LPP responses in participants. Both of these effects were mitigated by the use of a reappraisal strategy. However, no association between loneliness levels reported by participants and markers of response to the vignettes was observed in the current cohort of participants.

ID: 259

Neurophysiological markers of response to affective stimuli under cognitive reappraisal strategies

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The current conceptualizations of affective response frame it as an interplay between bottom-up processes which steer our attention to salient environmental stimuli (e.g. threats) and top-down mechanisms which allow us to downregulate it if needed. Loneliness is believed to affect both types of processes by increasing one's tendency to respond to social stimuli as threatening while concurrently decreasing one's ability to use top-down emotion regulation techniques like cognitive reappraisal (CR). The current study aimed at investigating these mechanisms by using well-established neurophysiological markers of affective response to static affective (neutral vs negative) stimuli with either social or nonsocial content. During the main task 80 participants (44 females, mean age = 24.15) were asked to either passively view stimuli or reappraise negative stimuli depending on the preceding cue. Participants behavioral ratings of arousal and valence elicited by the stimuli as well as EEG event-related potentials and short-term changes in electrocardiographic (ECG) and electrodermal (EDA) activity were analyzed. In line with the previous literature, affective content of stimuli produced increased arousal and valence ratings, elevated late positive potential and short term ECG deceleration. Furthermore, all of the analyzed markers with exception of ECG were affected by use of the cognitive reappraisal strategies. However, we have not observed a significant relationship between any of the variables of interest and participants' loneliness levels, as indicated by the UCLA-R questionnaire scores. However, as the current sample size does not adhere to personality neuroscience recommendations (n=150) these results should be treated as preliminary.

ID: 261

A Framework for Joint Music Making: behavioural findings, neural processes and computational models

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Musical ensembles constitute a microcosm of social interaction. In this work, we aim to provide an overview of the existing experimental (behavioural and neuroimaging) and theoretical (computational modelling) studies from this emerging research area. We propose a simple framework to encapsulate the most prominent themes orbiting the topic of joint music-making. Our framework is grounded in interpersonal coordination; studies of this phenomenon have explored the interpersonal exchange of information that promotes temporal synchronization, in addition to the cognitive processes that facilitate joint action. We also highlight the influence of experience (familiarity and expertise) and future goals (strategies) on coordination. The former entails previous knowledge of the co-performer's performance style or the musical material, among other factors, and the latter includes elements such as personal roles, body movement, and eye gaze: both dimensions variably affect musical performance. Lastly, we consider the influence of social factors (such as personality differences) that might directly or indirectly modulate the previously-mentioned elements. Our proposed framework may be useful to inspire novel research questions in joint music-making and to compare research outcomes with results in non-music-specific fields that examine social processes.

Are neocortical reference frames necessarily representational?

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Recent progress into neocortical research (Hawkins et al. 2019, Lewis et al., 2019) has revealed the presence of cortical grid cell-like neural structures in the neocortex. Those cortical grid cells encode features of objects as a set of reference frames.

Intuitively, those findings have been linked with a representionalist understanding of the cognition, where reference frames represent sensorimotor features of objects. The excitation of a set of reference frames then encodes and represents external objects.

However, findings on cortical grid cell-like neural structures can arguably also be explained within a non-representational framework (Hipolito, 2022; Piccinini, 2006). Raja (2017) in reference to Gibson (1966) alongside Hutto et al. (2014) for instance shows that cognition is primarily explained in terms of a dynamic coupling of internal and external variables called resonance (enactivism) - similarly to the activation of particular reference frames for an apple is coupled with the perception of an apple.

In this paper, I will review the representational as well as non-representational interpretations of neocortical reference frames. I conclude that the theory of reference frames indeed requires a representational understanding of cognition.

No pain, no gain: Neural correlates of effort-based decision making in anhedonia

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In our daily lives, we often must invest effort to gain a reward. Consistently diminished motivation to exert effort for reward may be a behavioral manifestation of anhedonia. Anhedonia is a severe condition that reflects disruptions in different stages of the reward process – from the "wanting" or anticipation over the "liking" or receipt of reward up to learning from reward. However, neural correlates of anhedonia have not been sufficiently established as many measures fail to dissociate between these different subcomponents. One key to this problem may be computational modeling which allows for more fine-grained and objective assessments to map subjective experience to neural activation.

Focusing on the amotivational subcomponent of anhedonia, we aim to relate neural correlates and behavioral parameters of increased effort sensitivity in effort-based decision making to self-reported anhedonia.

Seventy young healthy participants (aged 18-30), selected based on their trait anhedonia scores, completed a cognitive effort-based decision making task during fMRI. Additionally, participants filled out questionnaires on trait and state anhedonia facets and partook in two weeks of ecological momentary assessment (EMA) where they reported on their daily affect and rewarding activities.

We expect higher self-reported anhedonia to relate to decreased motivational behavior, i.e., steeper discounting of reward by effort, and altered activity in brain regions that code for cost-benefit valuation (e.g., dorsal anterior cingulate cortex, anterior insula). Combining traditional self-report with more sensitive (EMA) and objective (parameters from computational modeling) measures may enhance the detection of subclinical motivation difficulties, improving early diagnosis and prevention strategies.

How does personality play a role in the emotional categorization of gendered ambiguous facial expressions?

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Social interactions are inherent to human beings and affect almost every area of their lives. The accessibility of the face and the great diversity of its expressions make it possible to infer a significant amount of information to assess the intentions of others. The identification of emotional facial expressions therefore plays a decisive role in everyday life. However, some personality effects on the emotional categorization of ambiguous faces have been demonstrated, such as better anger discrimination in aggressive individuals or poorer fear discrimination in people with social phobia. These performances would not be attributable to a response bias - characterized by the systematic reporting of an

emotion even in its absence - but would instead reveal an expertise related to the level of exposure of these individuals to the emotion concerned. Furthermore, certain emotions would be better detected when presented on a face of defined gender: for instance, the expression of anger on male faces or the expression of happiness on female faces. Using male and female ambiguous facial stimuli with mixed expressions (i.e., happiness + fear, anger + sadness, etc.), we investigated the extent to which gender as well as personality traits (aggressiveness, anxiety, extraversion, agreeableness, openness, conscientiousness, neuroticism, motivational approach or avoidance tendencies) may improve or impair the discrimination of specific emotions (neutral, happiness, anger, fear, sadness, surprise) on a sample of 90 participants. To determine what falls under "perceptual sensitivity" as opposed to "response bias", we discussed the results using a psychophysical tool: the signal detection theory.

P300 and autistic traits in adults: a meta-analytical approach

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Several studies have examined the P300 ERP component in Autism Spectrum Disorder, but reported conflicting results. A previous meta-analysis found smaller P3b amplitudes in younger samples, but not in adults. Considering that the P300 amplitude stabilizes at age 16, it is important to analyse P3 in adult community samples with High (HA) and Low autistic traits (LA). As such, we conducted a systematic review and meta-analysis of 10 studies (N = 403 participants; HA, n = 200) relating P300 amplitudes and autistic trait scores in adult non-clinical samples. Overall, we found that the P300 did not differ between HA and LA (g = 0.254, p = .114). We performed moderator analyses for: (a) target (rare, deviant, non-neutral) versus control stimuli (neutral, standard stimuli), and (b) cognitive (e.g., oddball tasks) versus affective tasks (e.g., emotional faces). We found no differences between groups for control stimuli (p = .937), nor cognitive tasks (p = .664). However, a medium-size effect for targets (g = 0.471, p = .021) and affective tasks (g = 0.485, p < .001) revealed that P300 amplitudes were higher in the HA group. These results highlight that P300 differences in ASD may depend on task or stimuli and are in line with the predictive processing framework of autism, suggesting that these individuals may put less weight on their predictions and more on sensory input leading to a greater prediction error, especially when the stimulus is relevant and has emotional content.

Impulsive psychopathic traits increase N170 amplitudes to emotional face unpleasantness: Evidence for a hostility bias in an adolescent sample

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There is a longstanding debate on whether deficits in emotion processing are a core component of psychopathy. So far, regarding processing of facial expressions of emotion (FEEs) in adolescence, results are highly inconsistent. A dimensional approach to both psychopathy – considering Grandiose-Manipulative, Callous-Unemotional, and Impulsive-Irresponsible traits - and the study of emotions – accounting for the valence and arousal properties of facial displays - may shed new light on specific neural processing profiles of FEEs. The present study aims to assess the impact of different dimensions of psychopathy in the modulation of the N170 elicited by FEEs varying in emotional category (happiness, anger, calm, surprise), arousal (high, low), and valence (positive, negative). For this purpose, a sample of adolescents (n = 32) completed the Youth Psychopathic Inventory and observed FEEs during an EEG recording. The Impulsive-Irresponsible dimension of psychopathy was the only significant predictor of N170 amplitudes. Adolescents with higher levels of Impulsive-Irresponsible traits showed higher N170 mean amplitudes for facial expressions of anger, regardless of the arousal levels, and expressions of calm and surprise classified with negative valence. This effect was not observed for facial expressions of happiness. The results suggest a selective increased reactivity to facial displays of negative valence, which is consistent with the hostility bias expected to be found in individuals with a psychopathic disinhibition profile. This finding adds evidence to the triarchic model of psychopathy in adolescence and underlines the utility of a hybrid approach to emotions to tackle specificities in affective processing of facial expressions.

Early categorization of social affordances during the visual encoding of bodily stimuli

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Interpersonal interactions rely on various communication channels, both verbal and non-verbal, through which information regarding one's intentions and emotions is transmitted. Here, we investigated the neural correlates underlying the visual processing of hand postures conveying social affordances (i.e., hand-shaking), compared to control stimuli such as hands performing non-social actions (i.e., grasping) or showing no movement at all. Combining univariate and multivariate analysis on electroencephalography (EEG) data, our results show that occipitotemporal electrodes show an early (200 ms after image presentation) differential processing of stimuli conveying social information compared to non-social ones. First, the amplitude of two Event-Related Potentials related to the perception of body parts (i.e., the N190 and the Early Posterior Negativity - EPN) is modulated differently during the perception of social and nonsocial content carried by hands. Moreover, our multivariate classification analysis (MultiVariate Pattern Analysis - MVPA) expanded the univariate results by revealing two crucial time windows for distinguishing implied motion with and without social affordances over occipito-parietal sites. In conclusion, we provide new evidence suggesting that the encoding of socially relevant hand gestures is categorized in the early stages of visual processing and future studies will need to clarify whether and how fronto-parietal networks contribute to structuring this functional organization in the visual system.

ID: 287

How can contextual cueing with face stimuli affect the performance of younger and older adults? – An event-related potential study of visual search

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Contextual cueing, the implicit learning of the arrangement and dynamics of surrounding stimuli, is a potential candidate for helping everyday visual search situations like finding a person in the crowd. Since implicit learning is more intact than explicit with aging, we were interested if contextual cueing could be beneficial for older adults.

The experimental task was to find a male face between female faces. After replacing faces with colourful dots, participants had to show the location of the male face using a mouse. 30 blocks were shown and every block contained 12 repeated trials which were identical in every block and 12 new trials which were randomly generated. For the identity-repeat study (the same faces were shown together in the repeated trials but in random positions), we collected 24 young adults' behavioural data and for the all-repeat study (the same faces appeared in the exact same positions in the repeated trials), we collected 24 younger (18-30 years) and 25 older (60-75 years) adults' behavioural and EEG data.

Our results revealed that while the identity-repeat task (object cueing) did not facilitate the younger adult's performance in the repeated trials, the all-repeat task (spatial cueing) showed increased performance in both age-groups for the repeated trials which was detected in faster reaction time, lower error-rate, and increased N2pc component (attention orientation to target) compared to new trials.

In conclusion, contextual cueing of face stimuli can facilitate visual search performance in both age-groups but only if identity and location information consistently predicts the target.

ID: 297

Functional Connectivity as an index of subjective attitude towards robots

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Robots might be perceived as potential social partners in the near future. Humans have the tendency to anthropomorphize non-humans agents, and thus they may treat robots as intentional agents. On the other hand, given artificial nature of robots, people should treat them as artifacts. This potential for different ways of perceiving robots might result in adopting either the intentional or the design stance (Dennett, 1987). Here, we examined whether such attitudes towards robots can be differentiated on the basis of EEG fronto-parietal synchronization. Participants observed scenarios from the Intentional Stance Test (Marchesi et al., 2019) in which a humanoid robot was depicted performing daily activities. After being presented (auditorily) with two possible descriptions (intentional or design stance), participants were asked to move a cursor on a slider towards the description they considered as the best fit to the scenario.

Based on previous literature (Bossi et al., 2020), we selected pairs of electrodes to investigate functional connectivity as a measure of imaginary part of coherence (iCOH) in theta band (Nolte et al., 2014). We extracted iCOH values between frontal electrodes (F3, Fz and F4) and temporo-parietal electrodes (TP7, CP5, P5, P3, P2, P6, CP6 and TP8).

Preliminary results showed that participants adopting the intentional stance towards the robot had significantly higher fronto-parietal theta synchronization compared to participants adopting the design stance (Fz-P5: p=.03, RBC=.45). Thus, we argue that individual biases in adopting the intentional stance towards robots can be detected with functional connectivity between mid-frontal and temporoparietal regions.

ID: 299

Natural environments modulate pain: How contact to nature impacts the neural processing of pain

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Being in contact to nature has various beneficial effects on human health and well-being. Past studies indicate that being exposed to nature elicits a robust down-regulation of perceived pain. However, the psychological and neural mechanisms underlying this effect remain largely unexplored. While influential accounts from environmental psychology and neuroscience nicely dovetail each other in the proposed mechanisms underlying modulations of nociceptive processing, past research failed to investigate them in conjunction. In this poster we will present an ongoing study investigating how exposure to different environments modulates pain processing on a behavioural and neural level. In our study, 48 participants receive painful electrical shocks during observation of three different audiovisual stimuli depicting natural, urban, and neutral environments while fMRI activity is acquired. Based on past empirical findings we expect that exposure to natural stimuli will lead to a stronger down-regulation of subjectively reported pain when compared to urban or neutral stimuli. Going beyond past research, we expect that this modulation can be primarily explained by changes in neural activity in brain regions associated with either sensory-discriminative (e.g. somatosensory cortex) or affective-motivational (e.g. anterior cingulate cortex) components of pain processing. Furthermore, we expect that the intensity of pain modulation will be driven by interindividual differences in participants' feelings of connectedness to nature. By combining approaches from neuroscience and environmental psychology, we aim to shed light on the mechanisms underlying pain modulation by nature exposure. Data collection and analysis is still in progress and the results will be reported at the conference.

ID: 301

Dorsomedial prefrontal cortex plays a causal role for observational action learning

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Although dorsomedial prefrontal cortex (DMPFC) is involved during observational learning, it remains unclear whether it plays a causal role in observational learning and whether it is important for observational outcome and/or action learning. To close these gaps, we performed a within-subject transcranial magnetic stimulation study targeting DMPFC with continuous theta burst stimulation (cTBS) and assessed the effects of downregulating DMPFC on different forms of observational learning. To dissociate observational action from observational outcome learning, we used two conditions: 1) the action-only condition: only the action was observable, 2) the outcome condition: both action and outcome of the demonstrator were observable. Moreover, we varied demonstrator performance to dissociate learning based on observed outcomes from learning based on observed actions. With a bad demonstrator, one can learn only from observed outcomes but not from observed actions. Relative to vertex-cTBS, DMPFC downregulation led to decreased performance during action-based learning from a superb demonstrator, $F(1,29) = 7.01$, p=.013, but not from a bad demonstrator, $F(1,29)=.564$ p=.459. In contrast, cTBS had no effect on outcome-based learning, for both superb and bad demonstrators, $F(1,29)=.495$, p=.487, $F(1,29)=.003$, p=.954. Computational modeling revealed that DMPFC cTBS disrupted learning about the demonstrator's reliability and modulated the rate of learning from observed actions. Thus, our results suggest that the DMPFC plays a crucial role in observational action learning by adjusting the speed of learning regarding the reliability of the demonstrator.

ID: 303

Social brain networks in advanced Multiple Sclerosis patients: an explorative graph analytic approach

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Cognitive and emotional impairments have been found to alter quality of life and impact social cognition in persons with Multiple Sclerosis (PwMS). Although, the cortical network alterations related to social cognition in PwMS remain poorly understood, associations between emotional and cognitive dysfunctions have been identified. Potentially, these associations could be an avenue for new interventions, incorporating social cognition in neuropsychological assessment batteries and rehabilitation.

Here, we examined grey matter networks of brain regions involved in social cognition and emotional processing in cognitively impaired PwMS. Specifically, we explored whether cognitive rehabilitation affects structural connectivity in seven bilateral regions of interest (i.e., lateral occipital cortex, medial- and lateral orbitofrontal cortex, precuneus, insula, supramarginal & fusiform gyrus). T1-weighted MRI scans and neuropsychological tests of 15 PwMS were acquired before and after a 5-week cognitive rehabilitation program. Additionally, 5 healthy controls (HC) underwent MRI. Graph metrics (betweenness centrality, degree, clustering, path length) were explored.

Results showed differences between HC and PwMS in five regions of interest in baseline graph metrics. After cognitive rehabilitation, the right precuneus exhibited increased degree (p=0.01) and betweenness centrality (p=0.02). Also, left insula showed decreased path length (p=0.01) in PwMS.

Overall, cognitive rehabilitation seems to affect grey matter networks within brain regions related to empathy and mentalization. Graph analysis could be a promising approach to investigate connectivity of social brain networks in PwMS. However, the association between emotional processes, cognitive impairments and connectivity in MS requires further investigation to draw conclusions on the pathology's effect on social cognition.

Is watching fire uniquely relaxing? Electrophysiological evidence from a pilot study

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Fire has had a profound influence on human evolution, but it is still unknown exactly how the transformation happened. Early hominins may have experienced enjoyment and calmness when watching wildfires, presumably facilitating the first interactions with fire. Although we still praise fire for its relaxing effect in modern life, little research has addressed the underlying neurocognitive processes. In this pilot study, we created a fully controlled within-subject design to thoroughly investigate the electrophysiological correlates of watching fire using EEG, heart rate variability, and blood pressure. Six healthy young adults participate in a three-session experiment including a 20-minute video of 1) a bonfire, 2) a waterfall, another natural phenomenon associated with relaxation, or 3) a screensaver with white noise in the background, likewise considered relaxing. Data collection is still ongoing; nevertheless, we hypothesize that watching fire has a greater relaxation effect compared to the other two conditions. Specifically, based on previous research on relaxation in general, we expect i) increased frontal theta power, ii) increased parietal alpha power, iii) decreased functional connectivity in alpha and theta bands, iv) increased heart rate variability and v) decreased blood pressure. We expect that the relaxation effect is gradually reduced when watching a waterfall and a screensaver, respectively. Overall, our study could provide the first fully controlled and comprehensive electrophysiological evidence that watching a bonfire induce a relaxation effect unique to other comforting situations. An accurate description of the ways fire relaxes us could bring us closer to understanding its role in human social evolution.

Role of low-level visual features of symbolic stimuli in associative learning

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Salience association affects neural responses to abstract and symbolic stimuli. Previous studies demonstrated modulations of event-related brain potential (ERP) components, mainly reflecting influences on late stimulus evaluation (e.g., LPC). Salience associations have been shown to impact also earlier ERP responses such as the P1 component, indicating a role of low-level visual features of symbolic stimuli during associative learning.

However, evidence regarding the presence of these early effects is still inconclusive and little is known about the scale at which the association may occur.

In the present study, we investigated the role of low-level visual features of symbolic stimuli in associative learning and the effect of different scales of their manipulation by conducting two parallel experiments (N=24 each, between-subject design).

Strings composed of consonants and presented in different fonts, were associated with positive, neutral, or negative monetary outcome. The experiments differed in the scale of low-level visual features relevant for the association: characters of the string (experiment 1) vs. its font (experiment 2). ERPs were recorded in both experiments.

We predicted faster learning and enhanced LPC amplitudes to gain/loss associated stimuli, which was confirmed in both experiments.

The hypothesized enhanced P1 amplitude to gain/loss associated stimuli was observed only in experiment 1 and only for loss associated stimuli. This indicates a selective involvement of specific low-level visual features in associative learning. Interestingly, exploratory analysis revealed a modulation of the EPN component, which was previously considered to be limited to symbolic stimuli with a semantic content, such as words compared to pseudowords.

ID: 315

Modulations of attention orienting due to mutual gaze differ during brain stimulation to mPFC and rTPJ

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Mutual gaze is a social signal that conveys social information and is essential for subsequent nonverbal communication such as joint attention. However, it is unclear if modulations in attention orienting after engaging in mutual gaze are due to a "social effect" or a "non-social effect". Here, by stimulating social and general attention-orienting brain regions by Transcranial Magnetic Stimulation (TMS), we explored whether processing of mutual gaze is a social cognitive process or a non-social one. We collected data from 30 participants who received mPFC, rTPJ, and sham stimulation (i.e., a condition that mimics the sensory sensation of TMS stimulation) while completing a gaze-cueing task with a humanoid robot who did or did not engage in mutual gaze prior to shifting participants' attention to a lateral location where a stimulus might successively appear. Results showed that participants showed mutual gaze attentional modulations when they received sham stimulation only. Conversely, modulations were not evident for either mPFC or rTPJ stimulation. Still, general attention orienting was observed when participants received stimulation to mPFC, but not to rTPJ. These results suggest that the modulatory effects of mutual gaze on attentional orienting are due to an interaction between social brain regions and general attention-related brain regions.

ID: 323

Electrophysiological markers of feedback processing elicited by other's behaviour predict cortical responses to pain stimuli

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Predictive coding theories indicate that a variety of cues are used to predict events, to flexibly optimize behaviour and shape one's experience of upcoming stimuli. Among these cues, social variables seem to be of crucial importance in modulating the experience of pain. In the present study, we tested whether monitoring others' behaviour preceding administration of painful stimuli, influences subjective and cortical responses (LEPs) evoked by them. In particular, we explored whether amplitude of Feedback-Related-Negativity (FRN), (i.e. an ERP component elicited by expected outcomes) evoked by the behaviour of others prior to painful stimuli, predicted changes in LEPs.

We collected EEG from 32 healthy participants engaged in a modified version of the Dictator Game (where a player, the Dictator, split money between himself and a Receiver). The offer consisted of painful stimuli, instead of money. We manipulated: the Moral Valence of the offer (from Very Iniquitous to Equanimous splitting), the Personal Valence (offer Favourable/Unfavourable to the Receiver), and the Social Valence (Dictator's attitude toward the participant: positive/negative). Participants played the game in the Receiver role. They were shown the Dictator's decision about pain allocation (i.e. the feedback), then received painful stimuli, and rated their intensity and unpleasantness.

Using a Bayesian approach we found that Moral and Personal valence affects subjective ratings and LEPs. Reported Unpleasantness was lower for very iniquitous, and favorable offers. Importantly, FRN significantly predicts pain processing, with higher FRN predicting higher N2-LEP amplitude. Thus, processing others' behaviour prior to painful stimuli predicts the cortical activity evoked by them.

Neural Correlates of Anhedonia during pleasant Touch

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Anhedonia, i.e., the reduction or loss of interest or pleasure, is a severe symptom of many psychiatric disorders but can also be found in the general population. Research indicates that a dysfunction of any component of the reward process, for instance reward anticipation, consummation, or reward learning, could lead to subjectively reported anhedonia. During fMRI, consummatory pleasure is often assessed using monetary rewards. Here, we aim to examine the neural correlates of anhedonia during pleasant touch.

Seventy young healthy adults (aged 18-30), varying in trait anhedonia, completed an established affective touch paradigm during fMRI. After each of the 36 trials of visuo-tactile stimulation, participants subjectively rated the pleasantness of their experience. Anhedonia levels were assessed with established trait and state scales. We analyzed the neural activation related to positive and negative valence with two parametric modulators based on the individual subjective ratings. The positive valence modulator was selected to assess correlations with state and trait anhedonia scales.

On a whole-brain corrected level (pFWE < .05), we found significant peak activations related to state anhedonia in the ventro-medial prefrontal cortex (vmPFC) and the right inferior parietal lobe (IPL) area PFt. Our results indicate that in participants with high levels of state anhedonia activation in the vmPFC is more strongly tied to the subjective ratings of each trial, while activation in the IPL follows the subjective ratings of pleasure to a lesser extent. Thus, a complex picture of neural correlates of anhedonia during pleasant touch arises.

The role of intolerance of uncertainty in cognitive control and fear extinction

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Intolerance of uncertainty (IU) is a dispositional tendency that reflects the degree to which uncertain situations are perceived as threatening. We investigated the influence of IU in two cognitive domains: error processing and fear extinction. Errors have been conceptualized as endogenous forms of threat, hence together with fear conditioning, we can explore the role of IU in the processing of threat from both sources, internal and external. Participants completed two tasks, a Flanker task (FT) and a fear conditioning (FC) task. During the tasks we recorded the participants' brain activity via EEG and the skin conductance response (SCR), and participants completed the Intolerance of Uncertainty Scale, Short Form (IUS-12). In the FT with a final sample of 182 participants, we found that the total IU was not related with the error-related negativity (ERN; an event-related potential reflecting error processing) nor the two sub-factors of this scale (inhibitory and prospective IU), which contradicts previous findings. Additionally, IU did not moderate the relationship between depression with the ERN. Preliminary analyses of FC show that in 173 participants, the behavioral ratings (expectancy, arousal and valence) and SCR show the expected differences between acquisition and extinction phases. However, when IU is included in the analysis, it does not predict fear and extinction learning. This well powered study seeks to contribute in clarifying the role of IU in the human reaction to threat. Further analysis will investigate the associations between error monitoring and fear conditioning.

Who did that? Source monitoring errors for performed and observed actions

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Observing an action by another person may lead to false memories of oneself performing that same action. Evidence on this observation inflation effect is ambiguous, however: Some studies claim that it can only be observed with children and in cooperative tasks, while other studies obtained a more robust effect. In two experiments, we explored whether the choice of source monitoring tests could explain the contradicting results. We examined how participants remembered actions that they had previously performed, observed, or simply read about. In the first study, participants could only indicate whether they remembered having performed an action themselves, while in the second study, our design implemented a full source monitoring test that provided a detailed picture of different memory errors. The first study showed that participants indeed recognized observed actions often as actions that they had performed, while such misattribution was less common for actions that they had only read about. However, the full source monitoring test in the second study revealed that the error pattern was symmetrical, meaning that attribution of one's own action to the partner occurred with similar frequency as the appropriation of the partner's action. This suggests, that although source monitoring errors occur even in an adult sample, these do not reflect a

preferential tendency to recognize other's actions as one's own. Errors are rather caused by similarity of the perceptual experience or by overlap in the mechanisms that are involved in action observation and action execution.

Your hand or mine? Self-other overlap in interpersonal synchrony

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Research has shown that moving in time with others can have a variety of social effects, including stronger affiliation, cooperation, or conformity between co-actors. Self-other overlap has been proposed as a mediator of these effects, but the underlying mechanisms are not well-understood.

In this study, we investigated how interpersonal synchrony modulates self-other overlap at the motor level and at a conceptual level using a within-subjects design. Participants performed movements on a large touchscreen either in synchrony with a task partner or asynchronously. Each participant moved at a pre-set tempo, and the order of conditions was counterbalanced. After each block of synchronous or asynchronous movements, self-other overlap was assessed at the motor level using an automatic imitation task and at a conceptual level using a continuous version of the Inclusion of Other in Self scale.

In the automatic imitation task, participants responded to a number cue that was presented together with pictures of their task partner's and the experimenter's hand. The hands were shown performing either response-compatible or response-incompatible finger movements. We predicted that participants would have a stronger tendency to imitate their task partner's, but not the experimenter's, finger movements following synchronous compared to asynchronous movement.

Preliminary results show that participants have a marginally stronger tendency to imitate their task partner's hand following synchronous compared to asynchronous movement. Based on the full sample size (n=16), we will discuss why interpersonal synchrony increases self-other overlap at the motor level and how overlap at conceptual and motor levels may be related.

Sensitivity to basic emotional expressions and emotion perception space in the absence of facial mimicry: The case of individuals with congenital facial palsy

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According to sensorimotor simulation models, we recognize others' emotions by recreating the motor production of the perceived facial expression in ourselves. Therefore, congenital difficulties in producing facial expressions may affect emotion processing. We assessed a sample (N = 11) of Moebius syndrome (MBS) patients and a control group (N = 11) using a highly sensitive emotion recognition task. Leveraging the uniqueness of MBS, which is characterized by congenital facial paralysis, we investigated the role of facial mimicry and sensorimotor simulation in creating precise embodied concepts of emotion categories. Particularly, we focused on how MBS patients (as a group and for each MBS participants compared to the controls) perceive the intensity of primary emotions and how well they discriminate them from secondary (blended) emotions. Our results showed a significant decrease in the MBS ratings as a group of the intensity of sadness, fear, and disgust, which appeared to be close, and therefore confused with anger and surprise in the multi-dimensional scaling map, a method we implemented to qualitatively analyze the perception space of emotions. Further analysis of each MBS participant showed a strong tendency of almost all patients to perceive primary emotions as less intense when compared to the controls. In conclusion, our study provides evidence for a residual deficit in emotion processing in adult MBS individuals.

The integration of information regarding personality traits with facial expression during emotion inference

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Research into how we infer the emotional states of others – which sources of information are drawn upon and how they are integrated – has predominantly focussed on situational information and perceptual cues such as facial expression. How we might draw upon other available information relating to the personality traits of the specific individual whose emotion is being inferred remains unexplored. The present study sought to investigate whether the same emotional expression will be attributed different emotions when paired with different personality traits. Furthermore, it examined whether the resulting emotional inferences are as predicted by Bayesian models of cue integration, under which sources of information are weighted according to their precision (reliability, or confidence). Participants made judgments regarding the mean and variance of emotions experienced by target individuals based on trait information alone and based on artificially-generated expressions alone. They were then asked to make emotion judgments when both sources of information were combined, i.e., each identity was assigned a trait either positively or negatively associated with the relevant emotion (counterbalanced across participants). As predicted, participants made different judgments of emotion for identities with different personality traits expressing the same emotion. A precision-weighted model of cue integration was a better predictor of participants' inferences than an unweighted-mean model, yet judgments from trait information alone were the best predictor, suggesting that trait information had a greater influence on emotion inference than did expression.

ID: 351

Does this house have a face? Exploring the relationship between anthropomorphism and judgements of architectural facades

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Recent attempts to link architecture with brain and behavior have suggested face-likeness as an important façade characteristic due to a so-called "primal pattern" of capturing/drawing faces in houses. Evidence from cognitive neuropsychology indicates that faces and buildings place different demands on perceptual and cognitive processing, activating respectively the fusiform face area (FFA) and the parahippocampal place area (PPA). However, FFA is also activated when viewing objects with human-like attributes. Yet, it is not clear whether such attributes can actually predict positive judgements (e.g., preference). To investigate cognitive processing of facades and the role of anthropomorphism in appraisals, we planned three studies using standardized house images (DalHouses). We examined in the first study the underlying relationship between self-reports on face-likeness and other psychological attributes (N=305) following a psychometric network analysis approach. We replicated the study (N=36) including assessment of eye movements patterns and objective environmental quantification (i.e., facial/image features). A third (fMRI) study will compare potential FFA activation associated with facial features and appraisals. Results from the first study appear to suggest little relevance for perception of face-likeness in house facades. In the second study, we will assess correlations of gaze patterns to spatial and morphological features identified and classified in the facades, together with facial and low-level image features, and self-reports. We plan to employ representational similarity analysis methods in the third study. This project's aim is to inform design strategies on the psychological impact of living environments and fill in the void of current research in the field.

ID: 355

Referencing past physically painful experiences in empathy for others' insensitivity to physical pain

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Empathy stems from the notion that features of the self-concept can be located outside the individual, inside close and, occasionally, distant others. This blurring between self and other can lead to empathic outcomes such as affectively share and explicitly infer and understand others' inner states/emotions. Previous studies showed that empathy draws upon participants' autobiographical memories. Therefore, people use their self as a model to accurately represent the others' inner states. Critically, there are often circumstances in which the emotional experience associated with an event differs between the observer and the target of empathy. In these cases, referring to one's own experience can rather hinder the ability to empathize. In this study, we used electroencephalography (EEG) with the aim to explore how healthy participants react to an event that causes physical pain in targets that are indicated to be either sensitive (healthy, as the participants) or insensitive to pain (clinical condition of congenital insensitivity to pain). Preliminary behavioural data show that empathizers judge their empathy with lower rates in response to clinical compared to healthy targets described in physically painful contexts. Furthermore, time-frequency analysis showed high-frequency power decreases for clinical compared to healthy targets in painful contexts, reflecting memory suppression. This study seeks to explore how observers react to others' physical pain in contexts in which using the self as a model is not helpful to empathize. Preliminary findings suggest that empathizers inhibit their past experiences to regulate their empathic reaction.

Maternal interoception is associated with greater engagement in mother-infant stroking and rocking

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Caregiving practices provide a mechanism through which parentsactively manage the regulation of their infant's physical andemotional states. Recent models of embodiment propose that processesof interoception i.e., perceiving internal bodily states, may influence the quality and quantity of caregiving between parents and their infants. Yet, empirical investigations into this relationship remain scarce. Across two studies of mothers with a 6- to 18-month-old infant, we examined whether mothers' reported engagement in a variety of holding, stroking and affective communication behaviours was related to self-reported and behavioural indices of interoception. In Study 1, 148 mothers completed self-report measures of interoception and caregiving behaviours. In Study 2, we obtained interoceptive accuracy scores for 53 mothers, using the heartbeat counting task. The total sample of Study 2 (N = 115) completed the same measures of self-reported interoception and caregiving behaviours used in Study 1. Across both studies, the tendency to notice, pay attention to and regulate interoceptive signals was significantly associated with greater engagement in mother-infant stroking and rocking. Conversely, we found no evidence for a relationship between mothers' interoceptive accuracy and their engagement in caregiving behaviours. Our paper suggests that attentional and regulatory aspects of interoception play a role in the variation in mothers' engagement in affectionate caregiving behaviours, which support infants' physiological and emotional regulation.

ID: 148

Cross-modality effects in affective prediction construction: the role of past visual experience in subjective reactions to new affective pictures and sounds.

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Predictive models of emotion propose that people use past experience to construct affective predictions. We do not live in a stable world, however, and some environments are uncertain. Also, past experience is represented multimodally, combing information from different sensory modalities. In this study we investigated the effect of past (un)certain environments on subjective affective experience, and the cross-modality generalization of this effect. We used two S1-S2 paradigms as learning and test phases in two pre-registered studies. S1s were colored circles, S2s negative or neutral pictures or sounds. Participants (N = 192, 179) were assigned to the certain (CG) or uncertain group (UG), and presented with 100% (CG) or 50% (UG) S1-S2 congruency during learning phase. During test phase both groups were presented with a 75% congruency, and visual (Exp1) or auditory (Exp2) S2s. Participants rated the expected valence of upcoming S2s (expectancy ratings), or their valence and arousal. In both experiments we found more negative expectancy ratings after S1s previously paired with negative stimuli (Exp1: $F(1, 183) = 27.61$, $p < 0.001$; Exp2: $F(1, 183) = 9.38$, $p = 0.003$). No group effect emerged on valence and arousal ratings. Comparing experiments, no effects of sensory modality were found. Results suggest that relying on a certain past experience leads subjective expectancies to predict the same associations as previously experienced, and that this process develops similarly across visual and auditory sensory modalities. Subjective valence and arousal ratings are, however, not modulated by (un)certain past experience.

ID: 156

Neural underpinnings of context learning in posttraumatic stress disorder: A systematic review and coordinate-based meta-analysis of fMRI studies

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Context learning lies at the center of recent psychobiological models of posttraumatic stress disorder (PTSD) and has been associated with altered functional brain activity in the hippocampus, amygdala and ventromedial prefrontal cortex (vmPFC). In this systematic review and meta-analysis, we examine differences in functional magnetic resonance imaging (fMRI) in aversive pavlovian and contextual fear acquisition, extinction and renewal. The study was preregistered on the International prospective register of systematic reviews (PROSPERO; CRD42021275519). We only included fMRI studies with adult patients (>18 years), diagnosed with PTSD according to common classification systems (ICD, DSM) and compare the results to healthy trauma-exposed (TC) and unexposed (HC) individuals. In our systematic search, we identified 13 studies on PubMed, Web of Science, PsycInfo and by screening five existing reviews. The included studies comprise >500 participants using either of the tree protocols: context-dependent cue conditioning (n=7), cue-independent context conditioning (n=3) or combined context-cue conditioning (n=3). A subset of studies are selected and analyzed in a coordinate-based meta-analysis performed with Seed-based d Mapping (SDM-PSI), and the dataset is prepared to being made publicly available via repositories, such as Neurosynth. In addition, we provide guidelines and outline possible future directions for context conditioning research targeted at trauma-exposed populations, based on our findings. Context matters and a better understanding of its neural underpinnings provides important information for personalized medicine, and improving trauma-focused therapies including neurofeedback.

ID: 176

Mindfulness is associated with alcohol consumption and increased reward processing in ventral and dorsal striatum during anticipation and feedback

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The processing of non-drug rewards is an important mechanism in the emergence of alcohol use disorder (AUD), reflected in attenuated functional processing in striatal regions. Adolescence is characterized by both an increase in risky drinking, as well as protracted maturation of prefrontal control regions to regulate striatal reward processing. Recent interventions seek to enhance non-drug reward processing through mindfulness, a mechanism that targets attention processes of an individual. Here, we investigated the association between (trait) mindfulness, alcohol consumption and reward processing in healthy adolescents.

Fifty-five healthy adolescents aged 14 and 16 years completed the monetary incentive delay (MID) task during functional magnetic resonance imaging. Self-report questionnaires were used to capture alcohol consumption (AUDIT, TLFB) and mindful body awareness (MAIA). Functional activation estimates were extracted from 2nd level contrasts comparing anticipation and feedback of reward versus no reward in ROIs of ventral and dorsal striatum.

Lower levels of dispositional mindfulness, particularly attentional and regulatory processes, were significantly associated with stronger alcohol consumption, and higher activations in the ventral and dorsal striatum during the anticipation of rewards. The associations with the dorsal striatum were also observed for reward feedback.

Together these results highlight mindfulness facets as not only influencing alcohol consumption, but also being related to an alcohol use triggering mechanism of non-drug reward processing. Mindful body awareness might therefore mitigate the transition from risky alcohol use to the emergence of AUDs, and could be used also in combination with interventions that aim to increase the processing of non-drug rewards in AUDs.

ID: 180

Gentle as a mother's touch: C-tactile touch promotes autonomic regulation in preterm infants

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When caring for premature infants, kangaroo care effectively supports development. But preterm infants can benefit from other tactile interventions, as well. It is known that C-tactile (CT) afferents play a special role in mediating affective touch and are activated by slow stroking. Already in the first year of life, CT touch induces typical calming effects on the autonomic nervous system. Since preterm infants often struggle with impaired regulatory capacities, it seems reasonable to make use of these effects. However, the developmental time window and factors influencing the maturation of CT afferents and their further connectivity are still unclear.

In the present study, we investigated 32 premature infants (24 to 36 weeks gestational age at birth) who were stroked by their mothers. During baseline and stroking touch, the infant's heart rate was recorded as a parameter of autonomic regulation. Maternal stroking speed was determined by video analysis.

As a result, mothers used CT optimal velocities to stroke their children and the infants' heart rate decreased significantly from baseline when postnatal age was included as a covariate. In contrast to observations in mature infants, however, the decline in heart rate could only be stably detected after 140 seconds of stroking touch.

In conclusion, premature infants show typical reactions of the autonomic nervous system in response to CT touch, which speaks for a basic functional capacity of CT afferents. However, the delayed stimulus response indicates an immature connectivity of the cortical and autonomic circuits that could be favourably targeted by CT touch.

ID: 184

Grid-like codes in the human entorhinal cortex map visual space during memory formation

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Whether we will remember or forget is partly determined by the processes engaged upon the initial encounter of new information. For instance, when presented with visual input, we tend to actively sample information with saccadic eye movements to visually explore and extract relevant image features which can support recognition memory thereafter. Grid cells in the entorhinal cortex of animals and humans were recently shown to map visual space, similar to their role in navigating physical space. Here, we asked whether grid-like coding of visual space supported memory formation. Fifty human participants studied face and scene images while undergoing functional magnetic resonance imaging (fMRI) and continuous eye tracking. To determine memory performance, participants completed a recognition memory test immediately after studying as well as one week later. Results revealed significantly increased activation in the medial temporal lobe (including the hippocampus, parahippocampal and entorhinal cortices), the ventromedial prefrontal cortex and occipital regions when studying later remembered compared to later forgotten images. Focusing on eye movement-related activity, we found significantly increased grid-like codes in the entorhinal cortex when participants performed saccades to study later remembered images, but not when they studied later forgotten images. We provide first evidence that entorhinal grid-like coding of visual space supports memory formation.

ID: 188

Prosociality predicts sustainable decision making better than future-orientation

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Even though many people are aware of the imminence of climate change, most fail to engage in a sustainable lifestyle. On the one hand, sustainable decision making involves sacrificing present needs to preserve resources for future generations, on the other hand, it requires the ability to empathise with individuals belonging to future generations or even to the present generation who are already suffering from the consequences of climate change. Therefore, we expect future-oriented behaviour and prosocial behaviour to be crucial to sustainable decision making. To test this, participants performed a delay discounting task (future-oriented behaviour), a social discounting task (prosocial behaviour), and two novel behavioural paradigms measuring sustainable decision making. Prosocial behaviour significantly predicted sustainable choices in both tasks, whereas future orientation as assessed with the delay discounting task did not. Based on these results, we conclude that prosocial behaviour is a better predictor of sustainable choices than future-oriented behaviour. These results may invite public campaigns to redirect their focus on prosocial actions rather than future-oriented ones.

ID: 190

The frequency-dependent stimulation effects of rTMS on the performance of problem-solving tasks and ongoing oscillations

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Recent studies suggest that online repetitive transcranial magnetic stimulation (rTMS) can induce local entrainment of ongoing endogenous oscillatory activity that impacts cognitive performance, and the effect may depend on the function of the oscillation. However, little is known about the effects of task-specific frequencies, especially when using an online rTMS paradigm. Our previous electroencephalogram (EEG) study showed that the frontal theta rhythm is associated with the cognitive giving-up processes during problem-solving tasks.

In this study, we combined online rTMS and EEG to examine the frequency-dependent stimulation effects of rTMS on the performance of problem-solving tasks and ongoing oscillations. We hypothesized that rTMS at the theta frequency would induce ongoing theta activity and accelerate the giving-up behaviour.

RTMS was applied during problem-solving tasks with the following conditions: individual theta (4-6Hz)- and alpha (9-13Hz)-TMS, no-TMS, and sham-TMS; the order of conditions was counterbalanced across participants. The results showed that theta-frequency rTMS application induced an increase in theta amplitudes and shortened the giving-up response, while a control alpha-frequency rTMS application induced an increase in alpha amplitudes, but it did not change giving-up responses.

This study demonstrated the effectiveness of using specific task-relevant stimulation frequency and target location for the modulation of cognitive and behavioral performance. Furthermore, considering the close resemblance between giving-up behaviour and rumination in depression, neuromodulation of cognitive giving-up processes may lead to a new intervention to treat depression by rTMS.

ID: 194

Language comprehension is modulated by the subliminal perception of facial identity

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Human communication in social contexts is typically a multimodal situation. Increasing studies have suggested that spoken language comprehension may be enhanced by visual cues from the speaker. On the other hand, an important body of research has shown that personally familiar faces are preferentially processed, as the human face conveys relevant social and emotional information. However, how the comprehension system integrates both linguistic input and visual cues from social stimuli remains unclear. To this end, the present study aims to examine the influence of socially relevant visual cues (self-face, a friend's face, and an unknown face) on syntactic processing with a subliminal paradigm. Participants listened to sentences that could contain morphosyntactic anomalies while viewing a scrambled face preceding the linguistic violation. Facial identity was presented subliminally for 16 milliseconds embedded within the scrambled face. Event-related brain potentials (ERP) were analyzed using parametric and non-parametric tests. The vertex positive potential (VPP), related to face perception, showed early differences between a friend and unknown faces, whereas the N250 component was able to particularly discriminate the self-face from other identities. Analysis for language-related components revealed both LAN and P600 effects for all conditions. Yet, a larger LAN effect and a smaller P600 effect were observed only when the morphosyntactic error is preceded by the self-face, indicating a biased effect of cognitive resources for linguistic processing. Taken together, syntactic processing seems to be sensitive to social context, in particular, when it is perceived as self-relevant.

ID: 196

How communicative signals during joint attention promote mutual neural processes of infants and caregivers

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Communicative cues such as eye contact have been shown to increase infants' brain activation in response to visual stimuli (Hoehl et al., 2014; Hutman et al., 2015) and promote shared attention in early development (Hoehl & Bertenthal, 2021; Siposova & Carpenter, 2019). In this study, we assessed whether communicative cues (i.e. eye-contact, infant-directed speech and pointing) between infant and caregiver enhance dyads' mutual neural processes. For this we applied rhythmic visual stimulation in a dual electroencephalography (EEG) paradigm measuring simultaneously the brain activity of 11-12-month-old infants and their mothers (N = 49). To track mutual visual processing, we presented images flickered at 4 Hz, depicting natural objects (Cichy et al., 2016). Flickering images elicited neural responses at 4 Hz that were recorded with EEG (Köster et al., 2017) in order to assess dynamic changes in dyads' shared attention. Dyads observed the images in two distinct conditions: in a joint attention (JA) condition mothers communicatively showed the images to their infants; whereas in a joint watching (JW) condition dyads watched the images without communicative engagement. We hypothesised that communicative cues during joint attention will increase infants' and caregivers' attention to objects (Robertson et al., 2012) and facilitate a greater similarity between their mutual neural processes (Yoshioka et al., 2021). To test this, we will compare infants' and mothers' visual processing (elicited neural responses at 4 Hz) during JA and JW. This study will enable new insights into how joint attention modulates both infants' and caregivers' brain activities and shapes shared visual experience.

ID: 200

Early impact of task instructions on gaze processing: an EEG study.

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The direction of another person's gaze provides crucial information about their attention and intentions, which is essential for a fast and effective social interaction, especially when eyes make contact. Event-related potential (ERP) measurements provide accurate temporal tracking of neural processes related to gaze perception. While the sensitivity of the N170 ERP component in face processing is mostly recognized, research on the effect of gaze direction on this component has so far been inconsistent. However, differences in task instructions could explain part of these inconsistencies. In this study, we assessed the impact of task instructions on gaze direction sensitivity. Thirty-six participants performed the task, which presented faces with direct or averted gaze and non-face stimuli simultaneously on two hemifields with varying task instructions: i.e., face detection, gender categorization, and gaze discrimination. Behaviorally, we demonstrated faster processing for faces with direct gaze in the detection task and the gaze discrimination task, but not in the gender categorization task. The amplitudes of lateralized-N170, the marker of face encoding, were greater for direct gaze compared to averted gaze, regardless of the task. Critically, global brain activity analyses with two independent measures revealed a short-lived but significant interaction effect around 50-80ms, driven by differences between gaze conditions only in the gaze discrimination task. Our findings show the early impact of task demand on the sensitivity of gaze direction.

ID: 202

Being watched by a humanoid robot and a human: effects on affect-related psychophysiological responses

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Eye contact with a humanoid robot has been shown to evoke similar affect and affiliation related psychophysiological responses as eye contact with another human. In the pre-registered study, we investigated whether these effects are dependent on the experience of being "watched". Psychophysiological responses (SCR, zygomatic and corrugator facial EMG, frontal EEG asymmetry) to a humanoid robot's or a human model's direct vs. averted gaze were measured while manipulating the participants' belief of whether the robot/human model could see them or not. The results showed greater autonomic arousal responses and facial responses related to positive affect both to the robot's and the human model's direct vs. averted gaze, regardless of the belief condition. The belief condition influenced the overall magnitude of these responses to both stimulus models, however, to a lesser extent for the robot than for the human model. For the frontal EEG asymmetry, the effect of gaze direction was non-significant in both belief conditions. The results lend further support for the importance of eye contact in human-robot interaction and provide insights into people's implicit attributions of humanoid robots' mental capacities.

ID: 204

Whole brain Bayesian analysis of neural self-other-touch distinction

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Differentiating tactile information as coming from ourselves or someone else is crucial for establishing social interactions. A clear sensation of the boundary between the self and the surrounding world is elicited by touch. Our recent study identified a large deactivation in neural activity during affective self-touch compared to being touched by someone else. Using a partially new dataset, the present study aimed to corroborate these earlier findings with Bayesian statistics as compared to classical null-hypothesis testing. Forty-two participants (mean age = 24.6 years, gender balanced) were included in the analysis was performed in SPM12. In the task, participants either stroked their own forearm or were stroked on the forearm by someone else. The effect of interest was the contrast between these conditions. Classical 2nd level analysis with family-wise error correction (p = 0.05) and Bayesian second level modelling with a medium effect size threshold based on Cohen's d = 0.5 were performed. Both analyses showed activation in a network including superior temporal gyrus, temporoparietal junction, precuneus, and somatosensory areas for other-touch compared to self-touch. For self-touch compared to other-touch, only motor areas were identified. This is in line with our previous findings. Together, these findings suggest that Bayesian analysis is a comparable method, with the potential benefit of being able to identify the absence of an effect.

ID: 212

Negative scenes capture attention more strongly than neutral and positive scenes, and task difficulty does not modulate the emotional effect on the attentional capture: An ERP study.

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Delplanque et al. (2005) measured ERPs during a three-stimulus oddball paradigm in which emotional pictures were presented as deviant stimuli alongside a target and standard sequence. Deviant emotional pictures induced successive P3a and P3b. In addition, negative and positive scenes enlarged the P3b compared to neutral scenes. The effect was strongest with negative scenes. Similarly, Katayama & Polich (1998) found that the task difficulty is a major factor to modulate the deviant P3; high difficulty induced a large deviant P3 and this effect reflects enhanced attentional capture by deviant stimuli (Sawaki & Katayama 2007, 2008). Therefore, this study examined how the task difficulty interacts with the attentional capture by deviant emotional stimuli. Emotional pictures (negative, neutral and positive) were presented as the deviant stimuli during the target and the standard stimuli sequences, and the task was to respond only to targets. In addition, the task difficulty was manipulated by changing the similarity of the target and the standard stimuli. The result showed that the high difficulty enlarged the deviant P3a, and that the negative scenes enhances the deviant P3b. Importantly, the task difficulties did not significantly interact with the emotional effect on the deviant P3b. This indicates that negative scenes capture attention more strongly than the other scenes,

and that the strong attentional capture by the negative scene occurs automatically irrespective to how attentional resources are allocated in the oddball task.

Social task management: Switching between humanized and dehumanized perception - an exploratory EEG study

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Recent behavioral and neuroimaging studies suggest that people are constantly required to transition between a humanized and dehumanized mode of perception to adapt to changing contexts and navigate their complex environment. However, the temporal dynamics underlying the controlled switch between these two perceptual and behavioral orientations towards others remain unclear. Thus, in this paper we examined the switch between humanized and dehumanized perception using EEG. We recorded EEG activity from 19 (30.24 ± 11.98 years; 8 men) neurotypical participants who were presented with 80 color-images of individuals. To operationalize humanized and dehumanized perception, participants were asked to perform a social (warmth) and a financial (competence) decision task respectively, based on the images. The social and non-social task were presented in form of 'stay' or 'switch' trials. In the ‚switch' condition trials alternated between the two tasks, in the ‚stay' condition participants repeated the same task. As hypothesized, N170 amplitudes were larger to the social compared to the financial task. However, unexpectedly, P300 amplitudes did not differ between stay and switch trials. Supporting prior social cognition research, differences in N170 amplitudes indicate that a dehumanized mode of perception begins when early, exogenous, perceptual processes are employed. However, contradicting prior task-switching studies, findings related to P300 amplitudes suggest that task switching in social contexts is not implemented by endogenous, cognitive processes but by an alternative, yet unexplored, control mechanism. Thus, overall, we assume the control of social cognition to be distinct to the control of other previously researched cognitive systems.

ID: 216

Exploring the relationship between the perception of affective touch and endocannabinoid function in trauma and non-trauma-exposed humans

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Touch serves an important role in social interactions, as well as regulating our stress response. In particular, C-tactile (CT) afferent nerve fibres facilitate the pleasant characteristics of touch and are thus thought to serve an important function as a stress buffer. However, individuals with trauma may respond differently to touch. Emerging evidence suggests that the endocannabinoid (eCB) system is involved in both stress processing and social functioning. Thus, the eCB system may influence touch processing.

Therefore, in study one, we looked at preferences for affective touch in individuals with documented childhood trauma (N=52) or no trauma history (N=49). We also assessed variations of the endocannabinoid ligand anandamide (AEA). Trauma exposure was associated with marginally higher AEA levels. However, we found no significant interactions between affective touch preference and the trauma group. We observed an interaction between affective touch and AEA such that decreased preference for CT-touch was associated with higher levels of AEA. This indicates that AEA levels may be a driving factor when it comes to affective touch preference, not trauma history per se. In a separate study with healthy participants (N=46), we examined whether pharmacological enhancement of AEA had an impact on affective touch processing. Again, we found an interaction between preference for CT-optimal touch and AEA, where the high AEA group displayed less preference for affective touch. These findings suggest that both AEA and affective touch may play a role in stress buffering. Further studies using clinical populations or conducted during stress could be informative going forward.

ID: 218

Exploring the backbone of the self: A feasibility study of differential spinal cord activity during self-other-object touch

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Touch is crucial for identifying the physical border between our own body and the outside world, and hence plays an important role in our sense of self and social interactions. The distinct experiences of 'being touched' and 'touching oneself' are reflected in primary sensory brain areas, but also regions associated with social cognition and interoception. Interestingly, early evidence suggests that self-vs-other touch is already differentially processed at the level of the spinal cord, but the exact mechanisms are not yet understood.

In this feasibility study, 20 participants touched their own forearm (i), touched an object (ii) or were touched on their forearm by an experimenter (iii) during simultaneous functional MRI of the brain and spinal cord (cervical level (C) 5-7). The participants were instructed to stroke their left forearm and an object slowly and gently with their right hand to simulate real-life social touch.

Group analyses revealed two clusters (ventral at C5; dorsal at C6) of differential activation for self/other/object touch (F-test). Follow-up paired t-tests between the task conditions showed increased activation for object-touch vs. touch-by-other and, to a lesser extent, self-touch vs. touch-by-other.

In this feasibility study, the spinal cord showed activation differences during self/other/object touch, likely reflecting efferent right-hand motor signals and/or afferent right-hand sensory signals which are inherent to the object-touch and self-touch, but not to touch-by-other. A follow-up study with a larger sample size will be conducted to be more sensitive to touch-by-other on the left forearm, as well as to investigate brain-spinal cord interactions.

ID: 220

Identifying transdiagnostic socio-cognitive profiles across 4 clinical populations

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Our ability to understand ourselves and others is fundamental to our social well-being and everyday functioning. Such socio-cognitive impairments have frequently been observed across mental health disorders (e.g., schizophrenia, alcohol use disorder, depression). In the same vein, interpersonal difficulties are a strong common characteristic between these clinical populations. However, comparing these socio-cognitive difficulties between different clinical populations remains challenging. Two factors can be identified as impeding such comparison: (1) the tools and models developed and used are frequently dedicated to the assessment of a specific disorder, (2) inconsistencies can be observed within a single clinical population, possibly due to underappreciated heterogeneity between patients diagnosed with the same disorder. The present project aims to first examine the basic processes posited to underpin mentalizing skills across all populations. To this end, we introduce a new multidimensional framework of perspective taking that defines performance across two main dimensions (i.e., Self-Other Distinction and Self-Other Priority). Second, we attempt to provide evidence of either shared or common impaired processes involved in mentalizing across distinct clinical populations. Further, by decomposing the socio-cognitive deficits into its building blocks, we aim to distinguish different origins to interpersonal difficulties and classify patients within and across populations into distinct socio-cognitive profiles. Clustering analyses are conducted on data collected via two visual perspective-taking tasks. I will present preliminary evidence of transdiagnostic patterns and heterogeneity within 4 clinical populations: alcohol dependent patients (N =51), forensic patients with antisocial personality (N = 26), schizophrenia (N = 9) and anorexic patients (N = 12).

ID: 232

Brain Activation during affective Touch changes with the "Hunger Hormone" Ghrelin

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The "hunger hormone" ghrelin stimulates appetite and increases food intake. Evidence in both animals and humans suggests that ghrelin also affects the motivation to obtain and consume other types of rewards such as alcohol or drugs. This pre-registered neuroimaging study investigated whether ghrelin's effects extend to social rewards, namely affective touch, in humans.

Sixty-eight volunteers received social-affective touch and control touch on their shins during 3T functional imaging on two test days. On one day, participants stayed fasted, on the other day they received a meal to change ghrelin levels, assessed in plasma at three time points each day.

All touch was rated as more pleasant after the meal, but ghrelin levels were not associated with experienced pleasantness. A region-of-interest associated with reward processing, right medial orbitofrontal cortex (mOFC), showed decreased activation during all touch when ghrelin levels were high. During affective touch, larger ghrelin suppression following the meal was associated with higher mOFC activation, which in turn was associated with higher experienced pleasantness.

Overall, high ghrelin levels appear to reduce reward-related brain activation, which is in line with suggestions that ghrelin carries a negative valence signal. However, the negative valence did not transfer to subjective experience. The findings suggest that the effects of naturally circulating ghrelin levels might be restricted to conscious perception. The lower touch pleasantness when fasted can more likely be attributed to other factors that come along with energy deprivation, such as altered interoception.

ID: 236

Brain mechanisms underlying metacognition in decision making

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Rational decision making requires humans to possess metacognitive awareness of their preferences. Previous research has established a causal link between theta band oscillations in the frontopolar cortex (FPC) and metacognitive accuracy in value-based choice (Soutschek et al., 2021). However which brain regions interact with FPC in implementing metacognition remains largely unknown. Here we addressed this question by combining HD-tACS with concurrent functional MRI. Forty-one healthy participants underwent theta (5Hz), alpha (10Hz; control frequency) or sham stimulation over the FPC (AFz position) with a 3x1 high-definition electrode set up during task performance in the fMRI scanner (within-subjects design). Participants performed a confidence accuracy task, where they decided between smaller-sooner and larger-later monetary rewards and subsequently indicated their confidence in their decisions. Theta tACS impaired metacognitive accuracy in participants' reports of subjective uncertainty relative to sham stimulation, a finding in line with previous reports of improved metacognition following FPC disruption (Shekhar & Rahnev, 2018). Moreover, we observed that theta stimulation compared to sham resulted in altered functional connectivity between the FPC and dorsolateral prefrontal cortex, a region previously associated with tracking confidence and choice difficulty in decision making (Vaccaro & Fleming, 2018). Taken together, our results support the hypothesized causal role of theta FPC oscillations for metacognition and are consistent with an active account

of FPC possibly modulating communication with regions encoding confidence in order to metacognitively access relevant decision-related information.

The neural underpinnings of inclusion motivation in individuals with high and low loneliness

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Humans have a fundamental need to belong and affiliate with others. When this need is not fulfilled, people experience loneliness. Here we examine the neural underpinnings that are associated with increased "inclusion motivation", that is more active attempts to be included in social interactions, in high loneliness individuals. To assess inclusion motivation, we developed the Active Inclusion Task (AIT) which is based on the Cyberball paradigm. The AIT allows participants to actively influence their inclusion during conditions of fair-play and exclusion, by waving a virtual hand. We used functional magnetic resonance imaging to scan 26 high loneliness and 25 low loneliness individuals while they performed the AIT. We found that high loneliness is associated with increased inclusion motivation and decreased activation in the left insula when contrasting between fair-play and exclusion. Insula activation is implied in aversiveness, social motivation and effort exertion. The blunted neural discrimination between the two conditions may indicate that lonely individuals experience fair-play and exclusion similarly, perhaps due to negative expectations. However, high loneliness individuals are willing to work harder for inclusion when 'safe' affiliation opportunities are present. Therefore, inclusion motivation may serve as a new intervention target for loneliness.

Behavioral and neural dissociation of social anxiety and loneliness

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Loneliness is a public health concern with detrimental effects on physical and mental well-being. Given phenotypical overlaps between loneliness and social anxiety (SA), cognitive-behavioral interventions targeting SA might be adopted to reduce loneliness. However, whether SA and loneliness share the same underlying neurocognitive mechanisms is still an elusive question. The current study aimed at investigating to what extent known behavioral and neural correlates of social avoidance in SA are evident in loneliness. We used a prestratified approach involving 42 (21 females) participants with high loneliness (HL) and 40 (20 females) participants with low loneliness (LL) scores. During fMRI, participants completed a social gambling task to measure the subjective value of engaging in social situations and responses to social feedback. Univariate and multivariate analyses of behavioral and neural data replicated known task effects. However, although HL participants showed increased SA, loneliness was associated with a response pattern clearly distinct from SA. Specifically, contrary to expectations based on SA differences, Bayesian analyses revealed moderate evidence for equal subjective values of engaging in social situations and comparable amygdala responses to social decision-making and striatal responses to positive social feedback in both groups. Moreover, while explorative analyses revealed reduced pleasantness ratings, increased striatal activity, and decreased striatal-hippocampal connectivity in response to negative computer feedback in HL participants, these effects were diminished for negative social feedback. Our findings suggest that, unlike SA, loneliness is not associated with withdrawal from social interactions. Thus, established interventions for SA should be adjusted when targeting loneliness.

The neurocomputational basis of self-benefitting vs pro-environmental behavior

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Climate change is one of the biggest challenges humanity has ever faced, but the fields of social and decision neuroscience have contributed surprisingly little to our understanding environmentally-relevant behavior. Acting pro-environmentally is often time-consuming and effortful (e.g. walking instead of taking the car). In this poster we will present an ongoing Ph.D. research program investigating how people devalue the benefit to the environment by the amount of time and effort required of them, and the neurocomputational mechanisms underlying the decision process. In a first experiment, 74 participants engage in two decision-making tasks, where they can earn money for themselves or an environmental organization working on reducing CO_2 emissions, by investing 1) their physical effort (measured by a hand-grip force device) or 2) their time (operationalized as a waiting period). Based on research from the prosocial domain we expect that people will discount rewards for the environment more strongly than rewards for themselves, and that the difference in the discounting parameters will be related to their climate change beliefs. The study was preregistered prior to data collection, data analysis is in progress and the results will be reported at the conference. In the second part of this research program participants engage in the same effort-based decision-making task while undergoing fMRI and then complete ecological momentary assessment of their everyday pro-environmental behavior, with the goal to use brain data to predict real-life behavior. By combining neuroimaging and behavioral data, we aim to shed light on the neurocomputational mechanism underlying acting pro-environmentally.

ID: 252

Keywords: loneliness, the social brain, heart rate variability, social neuroscience

Does a brief induction of loneliness impact neural markers of social information processing and associated parasympathetic response?

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Perceived social isolation ('loneliness') has been associated with multiple adverse health outcomes. Loneliness has also been linked to altered patterns of neural activity during the processing of social stimuli, as well as to reduced parasympathetic regulation, measured by changes in heart rate variability (HRV). The current study aimed to test effects of a short-term loneliness induction on neural activity during social information processing and the associated parasympathetic response, indexed by vagal flexibility.

Sixty-three adults (31F; 24.52±4.33y) participated in a two-session study. Participants were informed that, based on the questionnaires completed during the behavioral session, they would receive feedback concerning their future social relationships during the consecutive fMRI session. However, their feedback was randomly assigned to induce either loneliness (Future Alone group, FA; n=31) or feelings of belonging (Future Belong group, FB; n=32). Afterwards, they were presented with positively and negatively valenced pictures with social or nonsocial content while their neural and cardiac response was captured with fMRI and photoplethysmography.

The mean of HRV collected during the session was subtracted from HRV measured at rest to create a vagal flexibility index, which was used to further test its associations with brain activity during observing social versus non-social scenes. In the FB group, vagal flexibility was positively correlated with right amygdala and medial prefrontal cortex activation, while no such association was observed in the FA group. These results suggest that even a brief induction of loneliness has an impact on neural activity and physiological response to social stimuli.

ID: 264

Keywords: self-preference, attention, saliency, familiarity, ERP

The self and a close-other: P3 evidence for differences between processing of faces and newly acquired information

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Prioritization of self-related information (e.g. self-face) may be driven by its extreme familiarity. Nevertheless, the findings of numerous behavioral studies reported a self-preference for initially unfamiliar information, arbitrarily associated with the self. In the current study, we investigated the neural underpinnings of extremely familiar stimuli (self-face, close-other's face) and stimuli newly assigned to one's own person and to a close-other (abstract shapes). Control conditions consisted of unknown faces and unknown abstract shapes. Reaction times (RTs) to the self-face were shorter than to close-other's and unknown faces, whereas in the case of shapes no RTs differences were observed. P3 amplitude to the self-face was larger than to close-other's and unknown faces. However, in the case of shapes P3 amplitude to the self-assigned shape and P3 amplitude to the shape assigned to the close-other were similar, and both were larger than P3 to unknown shapes. This lack of differences may be mainly driven by similar attentional biases to self-assigned shapes and shapes assigned to the close-other.

Neurobehavioral mechanisms of psychopathological comorbidity: an RDoC multimethod assessment

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This study links different-modality indicators of RDoC constructs (self-reports, behavior, and error-related brain activity) to explore their association with distinct internalizing-externalizing dimensions of the HiTOP model. Participants (N = 182; 54% females) completed a questionnaire assessing HiTOP dimensions along with self-report scales and EEG tasks of RDoC constructs: Performance Monitoring and Inhibitory Control (Cognitive Systems domain), and Sustained Threat (Negative Valence Systems). Unidimensional factors were successfully extracted for each one of these RDoC constructs by using a psychoneurometric approach. Building on these findings, we explored the patterns of association between concrete RDoC referents and psychopathology. RDoC-based psychoneurometric constructs of Performance Monitoring and Inhibitory Control appeared to reflect distinctive processing deviations associated with the internalizing spectrum, possibly unveiling comorbidity mechanisms across internalizing conditions. In turn, the RDoC-based psychoneurometric factor of Sustained Threat exhibited associations with both internalizing and externalizing dimensions, possibly reflecting a mechanism of comorbidity at the p-factor level increasing the vulnerability to developing any form of psychopathology. These findings provide a new approach toward a multimethod assessment linking neurobehavioral indicators with self-report measures and highlight that concrete RDoC constructs relate to mental health outcomes.

Is recognizing communicative interactions from biological motion related to autism spectrum disorders?

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Social cognitive (SC) deficits are a hallmark symptom of autism spectrum disorders (ASD). Next to well-documented theory of mind and emotion recognition deficits, biological motion (BM) processing might also be disrupted. Conflicting evidence exist regarding the ability of ASD individuals to recognize interaction from BM and its relation to autism symptoms. Thus, in the conducted study, ASD and neurotypical (NT) groups were compared with regard to the ability to recognize intention from BM, and its relation to ASD symptoms.

Twenty-eight adult individuals with high functioning autism (HFA:18F, 30.8+/-6.3 y.o.) and twenty-four NT adults (16F, 26.5+/-4.2 y.o) completed a Communicative Interaction Database (CID-12) task, measuring the ability to recognize interaction from biological motion. The task includes short movies with two point-light walkers (PLW) presenting various activities. Participants were asked to first classify them as individual or communicative, and then to choose one out of five detailed descriptions of actions performed by PLWs. Additionally, all participants filled out the Autism Quotient questionnaire.

ASD individuals scored significantly lower than TD group both in classifying and describing individual, but not communicative actions. CID-12 scores were correlated with AQ score.

Although pattern of results observed in the current study is similar to those that emerged from our previous research in clinical groups, i.e. patients with schizophrenia or temporal lobe epilepsy, it cannot be fully attributed to the tasks characteristics, as the ability to recognize interaction from BM was correlated with ASD symptoms.

Sex-related differences in recognizing negative emotions

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Emotion recognition not only plays a significant role in interpersonal interaction, but it also helps us in identifying social and environmental threats. Previous research provided evidence for the role of intra- and inter-individual differences in recognizing negative emotions. In this context, many studies reported women's outperformance in recognizing negative emotions compared to men, which might be explained in the framework of females' hormonal fluctuation across the menstrual cycle. Some studies indicate a positive relationship between progesterone levels and increased

recognition of threat-related emotions; however, there are some studies that did not report such a relationship. In the current project, two large-scale studies aimed to examine 1) sex as a frequently reported interindividual predictor in recognizing negative emotions (N = 425), and 2) the association between progesterone levels and recognizing threat-related emotions (N = 131). To bridge the gap between real-life and laboratory experience, facial, vocal, and combined stimuli were implemented. We predicted women's better performance in recognizing negative emotions (sad, disgust, anger, and fear) compared to men and a positive association between progesterone levels and increased recognition of threat-related emotions (anger, disgust, and fear) in women. Although our results showed a significantly higher rate of fear and anger recognition in women, we did not find compelling evidence regarding the association between women's progesterone levels and better recognition of threat-related emotions. Altogether, our findings suggest that sex differences in recognizing negative emotions exist; however, there might be other, more complex, and interactive factors that play a role in explaining these differences.

ID: 276

Amplitude modulation of the Contingent Negative Variation in Psychopathy: A meta-analysis

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The contingent negative variation (CNV) is a broad negative deflection of the brain event-related potentials that occurs between a warning stimulus and a target stimulus. This component has been studied in different EEG tasks, most of which based on classic conditioning, including participants presenting antisocial personality disorders and/or psychopathic personality traits. Literature shows conflicting results regarding the CNV amplitude modulation by psychopathy scores, reporting mostly diminished CNV amplitudes. A systematic review of the literature was conducted to shed light on this relationship and meta-analyze the modulation of the CNV amplitude by psychopathy. Nine studies (n = 278), reporting 18 effect sizes of the association between CNV and psychopathy scores, were retained for quantitative meta-analysis. Even though the number of studies reviewed was not ideal for such analysis, and more research is needed to support our findings, results showed a significant negative overall effect size that indicates augmented CNV amplitudes in psychopathy, Hedges' g = -0.31, 95% CI [-0.58, -0.04] (effect size is negative as the CNV is a negative going deflection). There was no evidence of publication bias. Heterogeneity analyses also showed that there were no significant effects of type of stimuli (e.g., visual, auditory) nor of type of response required (active, passive). In conclusion, this meta-analysis does not confirm previous reports of blunted CNV amplitudes in psychopathy. Instead, suggests a new view regarding the modulation of the CNV by psychopathy, as it might reflect enhanced attentional resources allocated to processing warning stimuli.

ID: 282

A meta-analysis of longitudinal total brain volume reports in autism

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Early brain overgrowth is a replicated neurophenotype associated with autism, however it is unclear how the brain develops in later childhood, adolescence, and adulthood. The aim of this meta-analysis was to describe volumetric and longitudinal growth trajectories of total brain volume (TBV) in autism compared to typically developing controls. Four electronic databases were searched from inception through January 2022: PubMed, PsycINFO, Embase and Web of Science. Studies were eligible providing they used a longitudinal case-control design and collected mean and standard deviation measurements for TBV. Hedges' g effect sizes were calculated for volume and annualized rate of change (ARC) using random effects models. Eight studies were included for meta-analysis, representing a pooled 559 individuals with autism and 3635 controls. Mean ages ranged from 6 months to 30 years and all but one study had >80% males. There was a non-significant effect of TBV across all timepoints, but meta-regressions revealed a significant relationship between age and TBV (F = 22.67, p <.000), with overgrowth restricted to early years and reduced volume in adulthood. Growth patterns were significantly different between groups, with slower ARC in autism compared to controls (g = -0.23, p = 0.001). IQ was significantly related to TBV. The present meta-analysis found autism to be associated with brain overgrowth during early childhood, advanced degeneration in adulthood, and slower rates of growth compared to controls. Knowledge of these trajectories may help inform early diagnosis and interventions to negate the possible clinical side-effects of pathological aging.

ID: 284

N170 and the Black Sheep Effect

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Inter and intra-group relations have been a topic of interest for Social Psychology. According to the Black Sheep Effect, normative and deviant members of the in-group are judged more extremely relative to their out-group counterparts. Social Neuroscience contributes to unveil the neuronal mechanisms of this effect. In this study we explored the ERP correlates of the Black Sheep Effect while controlling for Empathy related domains. The experimental procedure consisted in the presentation of pictures of four targets representing two within-participants factors: Group (members were presented as either in-group/same University or out-group/competing University); and Status (members were either normative/according to the standards of the society or deviant/violating the standards of the society regarding their opinions on several controversial social issues). ERPs were extracted considering the presentation of the target's face to analyse the N170. All participants completed the Interpersonal Reactivity Index (IRI) for self-reported Empathy. Preliminary results with 12 participants show that higher scores on IRI's Perspective Taking are associated with smaller N170 amplitudes for deviants in both in-group and out-group conditions. Furthermore, results show a tendency for a main effect of Status with higher N170 amplitudes for deviant targets when compared with normative targets. Additionally, a Group X Status interaction shows that the normative-deviant target differentiation is only present in the N170 to in-group targets. These results suggest that Group and Status seem to modulate N170 in a minimal group manipulation.

Effects of acute stress on entorhinal grid-like codes during virtual spatial navigation

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Navigating the physical environment relies on brain regions in the medial temporal lobe. More specifically, the entorhinal cortex is known to house grid cells that are a central component of spatial navigation. Stress can have detrimental effects on navigation and memory but whether this relies on a stress-related impairment of grid-like coding is currently unclear. Here, we asked whether acute stress affects spatial navigation, memory, and associated entorhinal grid-like codes. Human participants underwent functional magnetic resonance imaging (fMRI) while navigating within a virtual-reality environment and retrieving object-location associations. After baseline measurements of spatial navigation performance and entorhinal grid-like coding, participants were either subjected to a stress induction or to a non-stressful intervention and repeated the task thereafter (stress and control groups, respectively; currently n = 20 each). Participants of the stress group were significantly more stressed, anxious, and unhappy. As expected, navigation was associated with increased activation in the posterior medial temporal lobe, retrosplenial, parietal and occipital regions, as well as with thalamic and striatal areas. First analyses showed that this results profile was partly affected by stress, showing decreased navigation-related activation in parietal regions and increased activation in occipital regions after stress (compared to the control group). Together, this suggests that acute stress modulates brain activity related to spatial navigation. Data collection and analyses are currently still ongoing and final results of the behavioral data and entorhinal grid-like coding will be presented at the conference.

Pharmacologically increased cortisol levels impair recall of associative memory in men, but not women

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Laboratory studies have consistently shown that stress impairs item memory retrieval, and stress-hormone cortisol has been particularly linked to this impairment. However, it is unclear whether cortisol similarly affects the binding of items to associative context information in memory, i.e. the constituents of episodic memory. Here, we examine the retrieval of item and associative information under pharmacologically elevated cortisol vs. normal levels. Given that previous studies have shown sex differences in stress-induced memory modulation, we additionally assessed whether there may be sex differences in cortisol effects on memory retrieval. 84 female and male participants were tested in a placebo-controlled, double-blind, between-subject design, assigned to either a cortisol (10 mg hydrocortisone) or a placebo group. Participants of both groups were presented emotional and neutral foreground images on neutral background scenes. 24 hours later, participants' memory for the images and their associated background scene was

tested with a recognition task 20 minutes after substance administration. Item memory did not differ between the placebo and cortisol group. In contrast, in men, but not women, associative memory for the background scene was lower in the cortisol vs. placebo group. Moreover, the individual cortisol increase during the recognition task was negatively correlated to memory for the background scenes of the emotional foreground images only in male participants of the cortisol group. This study shows that pharmacologically increased cortisol levels distinctly affect associative memory in female and male participants, but have no effect on item memory, indicating a complex interaction for the stress effects on memory.

ID: 292

Predictive processing modulations in a social perception behavioral task

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Even though intuition suggests that perception follows sensation, increasing evidence indicates that the brain does not process information passively, but instead predicts and attempts to explain the incoming sensory input. This process, called predictive coding, consists of comparing the prediction with the actual sensory input obtaining a prediction error, which will be used by the brain to update the internal model to improve future predictions. In a previous report using a social perception paradigm, we showed that predictions impact how we perceive others. In this study, we used noninvasive transcranial electrical current stimulation on the left dorsolateral prefrontal cortex (DLPFC), which occupies high levels in the processing hierarchy, during the same paradigm in order to explore the neural basis of such impact. Overall, we observed that noninvasive neuromodulation of prefrontal activity was able to modulate behavioral correlates, more specifically, it reinforced stereotypical facial expression predictions. Thus, we provide causal evidence in humans that predictive processing may be modulated in humans from the left DLPFC with behavioral consequences.

ID: 296

Dissociating psychopathic traits in facial mimicry: electromyographic responses to facial expressions of emotion

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Introduction: Psychopathic traits have been associated with abnormal patterns of social and emotional information processing, from which blunted empathic responses are central. Humans tend to react to the emotional expressions of others with facial mimicry, with several studies showing that facial mimicry is positively associated with both cognitive and affective empathy. In the present study, we explore how psychopathic traits are associated with facial mimicry during the passive visualization of facial expressions of emotion.

Method: 18 participants (assessed for boldness, meanness, and disinhibition psychopathic traits with the Triarchic Psychopathy Measure) visualized 4-second clips depicting transitions from neutral to emotional facial expressions of emotion (happiness and anger), while the EMG activity of the corrugator and zygomatic facial muscles was being recorded.

Results: Preliminary data suggests that meanness is negatively associated with reduced EMG responses to facial expressions of happiness and anger, in both the zygomatic and corrugator facial muscles, while disinhibition was positively associated with increased EMG responses to happy and angry faces. No significant associations between zygomatic and corrugator EMG responses with boldness were found.

Conclusion: These results suggest that psychopathic traits are distinctly associated with facial mimicry patterns during the visualization of facial expressions of emotion. As previous studies suggest that empathy is associated with increased muscular activation in facial mimicry, our results further support the central role of blunted empathic responses in the phenotypic expression of meanness.

ID: 302

Interactions of motivational and affective processes in time estimation

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Although effects of motivation and emotion on cognition are well documented, further research is needed to understand their interaction regarding attentional resource allocation in demanding cognitive tasks. In a previous study (Müller et al., 2021) using electroencephalography (EEG), we provided first evidence for joint effects of self-determined choice and emotional content (negative vs. neutral pictures) on the late positive potential (LPP) in a time-production task. Here, we aimed to (i) investigate, whether emotional valence (negative, positive, neutral) as compared to arousal determines this interaction and (ii) whether 'denying a choice' or 'having no choice' differentially affects the size of choice effects.

For this, N = 32 participants performed a time-production task during EEG measurement – pressing a button after estimating 2 seconds in the presence of emotional pictures. The content category of the picture was either chosen self-determined or assigned randomly.

Behavioral results indicate longer, less accurate production times for neutral pictures compared to emotional pictures. EEG results revealed main effects of choice and emotional content on the LPP during task engagement with greatest LPPs for negative pictures and self-determined choices. An interaction of both factors in the time window 550-700 ms indicates greatest choice-dependent LPP increases for the neutral compared to the emotional conditions. The preparatory Contingent Negative Variation was greater for self-determined choices compared to the "no choice" condition.

These findings indicate that emotional and motivational task context are not independent but interact in allocating attentional resources to the present task.

Brain and spinal cord interactions underlying conditioned pain modulation

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Conditioned pain modulation (CPM) reflects endogenous pain control capacity where "pain inhibits pain", influenced by various factor such as physiological responsiveness, attention and expections. We investigated the involvement and interactions of the descending pain modulatory pathway in the spinal cord and the brain during conditioned pain modulation with pressure in healthy humans. We measured 13 healthy human volunteers in a behavioral study, and 40 healthy volunteers in a functional magnetic resonance imaging (fMRI) study with near-simultaneous imaging of both the brain and the cervical spinal cord segments C5-C7. Both studies used a within-subjects design with simultaneously experienced conditioning pressure (either painful or non-painful) and test pressure pain stimuli. Pressure was applied with an automated cuff algometer on the upper arms. In the behavioral study, participants had significantly lower test pain stimulus ratings during painful than non-painful conditioning pressure. Therefore, we established that it is possible to elicit strong CPM (Cohen's d = 0.99) in healthy volunteers using simultaneous tonic conditioning stimuli of moderately-to-highly painful pressure and repeatedly rated moderately painful phasic test stimuli in a block-wise manner. Such a paradigm is well-suited for fMRI studies where many repeated trials are required to reliably estimate neural responses, in contrast to most previous CPM studies that used one tonic conditioning stimulus period contrasted with one control period, and/or measured conditioned pain modulation with pre- and post-stimulus pain detection and tolerance thresholds instead of repeated stimulus-wise painfulness ratings. We will report the results of the fMRI part of the study in the conference.

Spatial contextual cueing in younger and older adults: An ERP study

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Information extracted from the environment influences how well we perform a task. Contextual stimuli are often distractors, irrelevant and possibly detrimental to the task at hand. Context, however, can also have a facilitating effect on performance, e.g., orientation in a familiar environment. We suggest that effective utilization of context may compensate for cognitive functions that deteriorate with age.

In this study we investigated the effect of spatial context on performance in younger and older adults in the spatial cueing paradigm. Visual displays containing a task-related target and task-irrelevant distractor objects were presented to the participants. Some trials ("repeated") had the same spatial configuration throughout the session, while the rest ("novel") always showed new spatial configurations. Similarly to earlier studies, younger adults were progressively faster for "repeated" compared to "novel" trials. The older group showed an identical improvement in reaction time for "repeated" trials. Previous electrophysiological studies attributed this improvement to more effective orientation of covert attention (measured with the N2pc component) and improved response-related processes (measured with the P3 and LRP components). In our study N2pc was overall earlier for "repeated" trials. The P3 was larger for "repeated" trials in the younger group, replicating earlier results. In the older group, however, P3 was larger for "novel" trials. Larger improvement in reaction time correlated positively with larger amplitude difference for both

components only in the younger group. While the electrophysiological results suggest different mechanisms, both groups were able to utilize contextual information to improve their performance.

Emotion regulation choice and flexibility in daily life

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How we regulate our emotions is essential for our well-being and social relationships. Emotion regulation (ER) is a highly complex, adaptive, and dynamic process and thus difficult to assess under restricted conditions. The few studies which investigated ER in real-life situations found large discrepancies compared to the results obtained from controlled laboratory studies. Furthermore, it has been suggested that not the use of specific 'adaptive' ER strategies such as reappraisal, but greater ER flexibility is related to increased adaptation to the environment and better mental health. We are especially interested in how health and well-being are reflected in ER choice considering situational and emotional factors, and how ER flexibility influences health and well-being. A better understanding of the ER process and its relationship with health and well-being require experimental designs that consider the complexity and dynamics of this process in real-life situations. We therefore implemented an experience sampling study using a smartphone application. Participants are asked randomly five times per day for two weeks to complete a series of questions if an emotional situation occurred. The questions characterize the situation, its context, experienced emotions, as well as used ER strategies and perceived ER success. Self-reports on well-being and health are collected separately. Multilevel modelling will be used to analyse how health and well-being are reflected in ER choice considering situational and emotional factors. Additionally, we will calculate a flexibility index to capture the high complexity and dynamics of the ER process and to investigate its role for the ER outcome.

Distinct neural correlates of signal and noise in the perception of facial emotion expressions

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The Assessment of Contextualized Emotions (ACE) is a novel model and method of Emotion Decoding Accuracy (EDA) associated with real-life social interaction quality (Hess et al., 2016) and personality (Kafetsios & Hess, 2021). The ACE infuses context by manipulating emotion expressions in a naturalistic group setting and assesses EDA by distinguishing intended emotions (signal), from additional, secondary emotions (bias, as regards the emotional message) during emotion decoding. The present study aimed to investigate the neural correlates of emotion perception regarding these two potential components, with the adaptation of the ACE into an fMRI-compatible task. Thirty participants (13 females) were presented with short blocks of neutral and emotional faces in single and in-group settings, and were asked to rate the emotion of the central character in categorical (condition 1: assessing signal) and dimensional (condition 2: assessing signal and bias) scales in consequent fMRI scans. Importantly, distinct brain activations were found associated with the perception of emotional vs. neutral faces in the two conditions. Moreover, individual perceiver's signal and bias scores, calculated from the original social psychology task performed online at another day, were linked to enhanced or decreased activation during the dimensional (vs. the categorical) run for emotional vs. neutral faces in single-face and group settings in distinct brain regions. Overall, these findings suggest distinct cognitive mechanisms linked to each type of emotional rating and highlight the importance of considering cognitive bias measures in the assessment of social emotion perception.

Dance expertise and emotional sensitivity

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Dance is a social practice capable of conveying emotional meaning, and bodily movements can activate emotional experiences. The aim of this study was to assess if dance expertise could enhance emotional sensitivity, comparing a group of dance experts with a group without regular practice of dancing.

One hundred and twenty participants (85 women, 30 men, and 5 unidentified) answered an online questionnaire consisting of the Berkeley Emotional Expressivity Questionnaire (BEQ), and the Emotional Sensitivity Questionnaire (ESS).

The results showed that dance experts in comparison to non-experts scored higher on ESS, more specifically, on the subscale Positive Interpersonal Sensitivity, related to the other-directed sensitivity. No significant differences were obtained on Negative Egocentric Sensitivity, the other subscale of ESS, and neither regarding emotional expressivity (BEQ). However, it was observed that those with more frequent dance habits scored higher on the Impulse Strength subscale of the Berkeley Emotional Expressivity Questionnaire.

These results present promising perspectives on the impact of dance in one's ability to perceive emotions, that could have interesting educational and clinical implications.

Syncing brains: real-time fNIRS-neurofeedback of inter-brain synchrony

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Social interactions are vital for us humans. We communicate with each other, we bond with each other, and we learn from each other. Recent advancements in simultaneous neuroimaging of two or more people's brains (hyperscanning) allows us to investigate brain signals during social interactions. Hyperscanning has been used to show that the people synchronize their brain activity during human social interaction, and that this interbrain-synchrony (IBS) is associated with better cooperative performance, bonding, and learning outcomes. Given the wide range of potentially beneficial effects of increased IBS in interactions, our objective is to develop a novel real-time two-person neurofeedback setup ("hyperfeedback") using functional near-infrared spectroscopy (fNIRS) to directly train IBS.

To this end, we performed simulations on how the length of windowed brain signals influenced IBS computations in terms of quality and reliability. These analyses were carried out using artificial brain signals as well as real hyperscanning data of two existing fNIRS-hyperscanning data sets. Dataset 1 included dyads playing a competitive game and dataset 2 included a teacher-learner setup in the context of song-learning.

Our analyses conclude that for intervals of approximately 50 seconds, the contrast-to-noise ratio is strong enough to provide a meaningful feedback measure. This finding is compatible with intermittent feedback, which has been employed successfully using fMRI.

Being able to train participants to voluntarily modulate their IBS will provide a novel approach for studying human interactions. Hyperfeedback might improve cooperation as well as understanding, and facilitate learning in health and disease.

Task corepresentation in survival processing effect

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Studies showed that when people encode information in pairs, they also learn the information related to the other party as well (Eskenazi et al., 2013; Elekes et al., 2015). These findings have been interpreted in terms of "co-representation" such that when people act together they create a representation of their partner's task as well, leading to an activation of an action plan regarding the task of their partner. Another line of research also found that encoding information in a survival context increases retrieval of this information, termed the survival processing effect (SPE) (Nairne et al., 2007). We propose that corepresentation of actions should be higher in the context of survival, as from an evolutionary perspective, representing the partner's actions in a survival situation can provide the person with more fitness benefits than other conditions such as moving to a new house. This higher representation, in turn, can lead to better memory for the information that their partner evaluated. From this logic, we have 3 expectations: 1) People will remember information they encode in a survival context better than information encoded in a moving context, replicating SPE. 2) People will remember information that their partner encoded better in a survival context than in a moving context. 3) People will remember information encoded by their partners in all contexts better than information that nobody evaluated.

Differential activation of behavioral immune system and norm violation reactions by covid-19 and flu

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Evolutionary hypotheses on human emotions suggest that emotions have various functions: Here, we link disgust and anger reactions towards COVID-19 related behavior from this perspective, as well as moral decision making. We hypothesize that, in situations faced with COVID-people, individuals will react with anger firstly, as a reaction towards rule violations or harm to others and then react with disgust, as a part of the Behavioral Immune System (BIS) to avoid infections. Here, we measured participants' COVID-19 prevention behaviors and their perceived vulnerability to- and avoidance of diseases. We presented them with vignettes in two conditions: encountering a COVID-19 or flu person at different disease statuses (positive, negative or ambiguous). The participants provided a moral judgment of the person's act, how disgusted and angry they felt towards it as well as which emotion they felt primarily. In line with the rule violation and harm hypothesis, we predicted higher levels of anger reaction compared to disgust in these vignettes. To explain the given disgust reaction, we expected participants with more awareness of and practice caution against COVID-19 to have harsher moral judgment against the COVID-19 person due to their BIS activation. Indeed, results showed higher levels of anger compared to disgust reactions.

Overall, the results indicate that COVID-19 triggers the rule violation and harm values in participants which triggers anger, more than it triggers the BIS. Even though COVID-19 is not perceived as harmless as flu, interestingly its rule obedience aspect is more dominant compared to its disease avoidance aspect.

ID: 338

Keywords: Cannabis, fMRI, neuropsychology, reward circuit, abstinence

Cannabis and the adolescent brain: a longitudinal assessment of mental health, cognition, and reward/feedback processing

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For many decades, cannabis has been the most widely used illicit substance in the world, particularly among younger individuals. Cannabis exerts its effects on humans mainly through its action at CB1 and CB2 receptors. Brain areas implicated in the reward circuit are amongst the regions with densest cannabinoid binding. Previous works suggest that mental health problems associated with cannabis (ab)use may result from its effect on reward processing, emotional processes, and cognition. However, the impact of cannabis on these domains remains unclear, particularly regarding its use in adolescence and potential long-term neuropsychological consequences.

Using data from the IMAGEN project, we are investigating the effects of early-onset cannabis use. Three groups (non-users, persistent users, abstinent users) were defined based on their cannabis use trajectory throughout three timepoints (14, 19, 22 years old). All participants were cannabis-naïve at baseline and matched on various measures. Groups are being compared regarding brain activity during a Monetary Incentive Delay task, psychopathology, and cognitive performance.

Preliminary results (i) suggest that cognitive impairment does not precede nor succeed cannabis use, but some psychological characteristics may differentiate between users and non-users; (ii) whole-brain exploratory analyses suggest that, overall, cannabis users may exhibit reduced brain activity during reward anticipation and increased activity during feedback processing compared to non-users even before cannabis use onset; (iii) as participants enter adulthood or abstain from cannabis, these patterns of brain activity appear to fade or shift direction. Further analyses will elucidate these findings and inform us on the effects of early-onset cannabis use.

ID: 344

Keywords: synchrony, coordination, joint action

Modes of interpersonal synchrony: is there a preference for in-phase or anti-phase coordination?

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Research on synchronous motor coordination often concludes that synchronization leads to positive outcomes (e.g., enhanced cooperation, Wiltermuth & Heath, 2009; Rabinowitch & Meltzoff, 2017) between interacting partners.

Most of the work looking at the positive effects of interpersonal synchrony has compared in-phase synchrony (performing the same movements at the same time) with asynchronous performance (performing the same movements at different speeds). However, unlike asynchrony, anti-phase synchrony (performing the same movement at the same time, with the interacting agents starting at the opposite position of the movement space) is also a common form of social interactions involving close temporal coordination. Could anti-phase synchrony lead to the same positive effects as in-phase synchrony?

In a study with adults, we measured direct preferences for in-phase, anti-phase, and no coordination by asking participants to select their preferred mode of task execution. Before each trial, we presented two, virtual, colored balloons (each representing a certain mode of task execution) to choose from on a touchscreen. After making a choice, participants completed a trial of inflating the selected balloon with their task partner by performing finger movements on a slider corresponding to the mode of task execution they picked. Movement kinematics from the virtual sliders were measured (similar to Noy, Dekel, & Alon, 2011).

Preliminary results suggest that participants prefer to engage in coordination compared to no coordination and show only a marginal preference for in-phase compared to anti-phase synchrony. It will be discussed how specific aspects of coordination shape joint action preferences.

A covarying grey and white matter circuit separates high from low accepters. A data fusion machine learning approach

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The use of emotional acceptance for maintaining mental health traces back to Greek philosophers and Buddhism. In the context of scientific investigation, acceptance is defined as an open and non-judgmental stance to fully experience emotions without trying to control or change. Previous neuroscientific studies have focused on strategies such as reappraisal, suppression, distancing, but only a few focused on nature of acceptance. Here we tried to understand whether specific covarying grey and white matter independent structural networks separate high- from low-accepters.

A novel data fusion machine learning approach was applied to the structural MRI scans of 128 individuals. The analysis returned twelve independent covarying grey and white matter brain circuits. Then, subjects were divided into 90 low- 74 high- accepters based on Acceptance ratings (CERQ, median split method). Gender and age were balanced inside each group (p>0.05). Logistic regression was used to separate high from low accepters.

The analysis returned only one separated low- from high- accepters network. This network was more expressed in high accepters compared to low accepters (higher grey and white matter concentration, p=0.018) and included regions largely overlapping with the Default mode network. At a behavioral level, high accepters used more frequently other strategies such as refocusing on planning, putting into perspective, positive reappraisal, and rumination compared to low accepters (p<0.006).

These results explored for the first time how high accepters differ from low accepters. In future these results may pave the way for neuromodulation treatments targeting specific brain circuits to increase the usage of acceptance.

CT touch induces a decrease in heart rate without any social context

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A gentle stroking touch within a velocity range of 1-10 cm/s, which optimally activates C-tactile afferents, is called C-tactile (CT) touch. Previous studies with psychological and physiological measurements have shown that CT touch elicits pleasant sensation and a state of low arousal. In those studies, however, the touch stimulations were given in participants' sight, thus, the participants were aware of the source of stimulation (i.e., experimenters), raising a possibility that social context affected the results. Therefore, we examined the effects of mere CT touch without social context on the subjective and physiological measures. Participants sat on the chair and sticked out their left arms, where we gave touch stimulations, through a curtain so that they could not see the source of stimulation. The experimenter sitting behind the curtain gave three types of touches (3 cm/s * 1 stroke, 30 cm/s * 1 stroke, 30 cm/s * 10 strokes) with a brush to the participant's arm (hairy, CT skin) or palm (glabrous, non-CT skin). The participant's heart rate, facial muscle activities, and subjective ratings of pleasantness were recorded. The results showed that the CT touch on the arm produced greater deceleration of heart rate than the other non-CT touches. Interestingly, this effect was pronouncedly observed in the second half of the experiment. No differences in the facial muscular responses and pleasantness ratings were observed. These results suggest that repeated stimulation by CT-touch affects arousal state even without social context, but that it may not be sufficient to elicit pleasant sensations.

How does art knowledge training impact judgments of artworks?

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The study of acquiring art knowledge can provide insight into the structure of underlying cognitive systems that supports skill acquisition and skill transfer. However, little is known about the impact of art knowledge training on judgments of artworks. In the current pre-registered study, we used a training intervention paradigm and multi-level Bayesian modelling approaches to investigate the ways in which an art lesson impacts subsequent judgments of artworks. During pre- and post-training, seventy-one art-naïve participants assigned ratings to representational artworks on several dimensions: preference, understanding, emotions, and artistic skill. During the training session, participants completed a 25-minute visual art knowledge lesson. The results showed an effect of training on aesthetic preference, understanding, emotions, and artistic skill ratings, indicating stronger evaluative judgments for trained rather than for untrained artworks. Furthermore, the effects of training generalise to unseen artworks as a function of how similar the unseen artwork is to the training materials. Specifically, the effects generalise to unseen artworks produced by the same, but not a different artist. Overall, these findings suggest that art knowledge shapes judgments of artworks, whilst also indicating constraints of the art training generalisability effects to novel artworks.

ID: 356

Associating affective voices to neutral faces – An online and ERP study

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There is evidence that visually presented neutral stimuli can gain additional relevance by their association with affective stimuli. Studies have shown effects of associated affect in ERP components like the Early Posterior Negativity (EPN), Late Positive Complex (LPC), or at even earlier processing stages as P1 or N170. However, findings are mixed as to the extent associated affect requires directed attention to the emotional quality of a stimulus and which ERP components are sensitive to task instructions during retrieval. In this preregistered study (https://osf.io/x58vy/), we aimed to test cross-modal associations of vocal affect-bursts (positive, negative, neutral) to faces displaying neutral expressions in a flash-card-like learning task, in which participants study face-voice pairs and learn to correctly assign them to each other. In the EEG test session, we applied both an implicit ("old-new") and explicit ("valence classification") task to investigate whether the behavior at recall and psychophysiological activation of the affect-based association depended on the kind of memory retrieval. We collected behavioral and neurophysiological data from 40 participants who reached the preregistered learning criterium. Results showed that for the EPN the processing of neutral faces after learning was different for negatively compared to neutrally and positively associated faces, independent of the task. However, affect-based associated effects at later stages (LPC) were only visible in the explicit, i.e. valence-classification, task. These findings support not only that cross-modal affect can successfully be conditioned to faces but also highlight the importance of the task at different processing stages.

ID: 358

The role of the opioid system in social cognition

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Several studies on empathy have found correlational evidence for 'shared representations' underlying our ability to tune into others. This theory proposes that individuals recruit similar neural representations both during the first-hand and empathic experience of a specific affective state. Recently, scientists have started to move towards causal manipulations to test this account. In psychopharmacological experiments it was discovered that the dampening effects of placebo analgesia on self-experienced pain, as well as empathy for pain, could be diminished by administering an opioid antagonist. This study aims to expand these findings by investigating the role of the opioid system in various sub-aspects of social cognition. The aspects in question are empathy for positive as well as negative emotions, processing of subtle dynamic facial expressions, empathic reinforcement learning, prosocial effort and participants' affective processing. We will use an opioid agonist (morphine) to target the opioid system directly and examine its effects on a battery of tests measuring the beforementioned aspects in a double-blind, within-subject, repeated measures design (N=60). Since opioid receptors are widely distributed throughout the human brain, we predict the opioid agonist to exert its influence on several of the investigated sub-aspects of social cognition. Some

expected findings include: a decrease in ratings regarding the intensity of another's facial expression; reduced ratings regarding another's pain, as well as reduced feelings of unpleasantness when witnessing another's pain; decreased willingness to exert effort to reduce another's pain; reduced incorporation of another's negative affect in the reinforcement learning task and reduced self-experienced negative affect.

ID: 362

Can people with SCA36 'Read the Mind in the Eyes'?

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Spinocerebellar ataxia type 36 (SCA36) is a late-onset autosomal dominant cerebellar ataxia with primary incidences being in "Costa da Morte" (Galicia, Spain). Patients usually present with motor symptoms around the fourth or fifth decade of life, which are preceded by manifestations consistent with cerebellar cognitive-affective syndrome before. Due to previous literature shows that the cerebellum also plays an important social role, we hypothesize that social cognition is impaired in this disease. We used the "Reading Mind in the Eyes" Test, which is designed to assess recognition of complex emotions in human faces, on 21 patients in different stages of disease progression -determined by Scale for the Assessment and Rating of Ataxia (SARA)-. SCA36 participants were matched in age (mean 57 ± 12 years), sex (12W/11M) and educational level with 21 controls. Patients seem to have more difficulties recognizing negative and neutral emotion valence images, even those in preataxic stage, before the first motor symptoms appear. Moreover, this impairment increases with the advance of the disease, correlating these values with the motor impairment measured with the SARA score. In conclusion, SCA36 patients seem to have difficulty understanding the mental states of others when relying on facial expressions. Although more studies are needed to further investigate this, our results suggest that the social cognition could be impaired in spinocerebellar ataxias and other cerebellar disorders, being the sociocognitive measures as potential predictors of the progression of disease.

ID: 363

A narrative sequencing and mentalizing training for adults with autism

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Adults diagnosed with autism experience difficulties with understanding the mental states of others, or themselves (mentalizing) and with adequately sequencing personal stories (narrative coherence). Given that the posterior cerebellum is implicated in both skills, as well as in the etiology of autism, we developed a narrative sequencing and mentalizing training for autistic adults. Participants with an official autism diagnosis were randomly assigned to a Training group (n = 17) or a waiting-list Control group (n = 15). The Training group took part in six weekly sessions in groups of three participants lasting each about 60 minutes. During training, participants had to (re)tell stories from the perspective of the original storyteller and answer questions that required mentalizing. We found significant improvements in mentalizing about others' beliefs and in narrative coherence for the Training group compared to the Control group immediately after the training compared to before the training. Almost all participants from the Training group expressed beneficial effects of the training on their mood and half of the participants reported positive effects on their self-confidence in social situations. All participants recommended the current training to others. Results are discussed in light of cerebellar theories on sequencing of social actions during mentalizing. Further improvements to the program are suggested. Our results highlight the potential clinical utility of adopting a neuroscience-informed approach to developing novel therapeutic interventions for autistic populations.