



ABSTRACT BOOK

7TH BI-ANNUAL ESCAN MEETING

22 – 25 MAY 2024, GHENT, BELGIUM
EUROPEAN SOCIETY FOR COGNITIVE AND AFFECTIVE NEUROSCIENCE

Sponsors



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Ghent University
Faculty of Psychology and Educational Sciences
Henri Dunantlaan 2
9000, Ghent
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WELCOME ADDRESS ESCAN President

Dear ESCAN members, conference participants,

Dear colleagues and friends,

On behalf of our Society's Board, we would like to warmly welcome you to ESCAN 2024, the 7th conference of the European Society for Cognitive and Affective Neuroscience in Ghent, Belgium. After the vibrant, inspiring, and exciting conference held in Vienna in 2022, we now look very much forward to meeting you in Ghent, a beautiful European city in the Flemish region of Belgium.

At our conference in Ghent, we will welcome three outstanding keynote speakers (Karin Roelofs, Salvatore Maria Aglioti, and Soyoung Park), the two recipients of the ESCAN Young Investigator Award (Jennifer Murphy and Simone Battaglia), and speakers 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. This edition of the ESCAN conference will also be marked with two special and inaugural events: a session organized by the newly formed Junior Member Committee; and a session dedicated to the Special Interest Group ESCAN-Social Neuroscience, which was created as a result of the merge between ESCAN and ESSAN (European Society for Social and Affective Neuroscience).

We are very excited about the range of symposia (34), oral presentation sessions (20), and poster sessions (3) that we will have in this year's program, 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, Emilie Caspar, Senne Braem, Ruth Krebs, Gilles Pourtois, Roeljan Wiersema, Daniele Marinazzo, Matteo Giletta, Annabel Nijhof, Raquel London, Lara Bardi, Hannah De Laet, who worked tirelessly for this conference. We are sure it will be a successful, exciting, and stimulating meeting that will bring together our community of past and new members.

We look forward to welcoming you in person!

On behalf of the Society's board,

Giorgia Silani and Agnieszka Wykowska

Presidents of ESCAN



WELCOME ADDRESS Chair Organizing Committee

Dear ESCAN attendees, ESCAN members, colleagues, and friends,

As the chair of ESCAN 2024, which will be held at Ghent University, I am delighted to welcome you and thank you for your remarkable participation. We expect approximately 600 attendees from various countries within and outside Europe to join us as keynote speakers, symposium contributors, or oral/poster presenters. This impressive number underscores the scientific significance of ESCAN and the vast diversity of topics it encompasses.

We are committed to ensuring that this conference is an enjoyable experience for all, both scientifically and socially. Good social interactions, fundamental for collaboration and the exchange of ideas, are crucial for scientific progress. To this end, we have organized a welcome reception, social event, and gala dinner at extraordinary venues, along with numerous coffee breaks and lunches. Ghent is an (objectively) beautiful city with a rich history, and we have chosen exceptional locations for our social events.

All practical information regarding the conference can be found on our website (escan2024.com) as well as in this booklet. This year, we are introducing free tutorials on a range of topics, providing additional opportunities for interaction. We are also dedicated to minimizing our environmental impact: there will be no printed programs, reusable water bottles will be provided that you can re-use post-conference, and we will ensure that Belgium's recycling protocols are clearly explained for all attendees. Please try to take part in these efforts by favoring low-carbon emission transportation methods when attending the conference.

But first and foremost, please enjoy this conference as much as we will!

On the behalf of the local organizing team,

Emilie Caspar,
Chair of ESCAN 2024



CONFERENCE INFORMATION

Conference venue

The 7th international conference of the European Society for Cognitive and Affective Neuroscience (ESCAN) takes place between 22-25 of May, 2024 at:

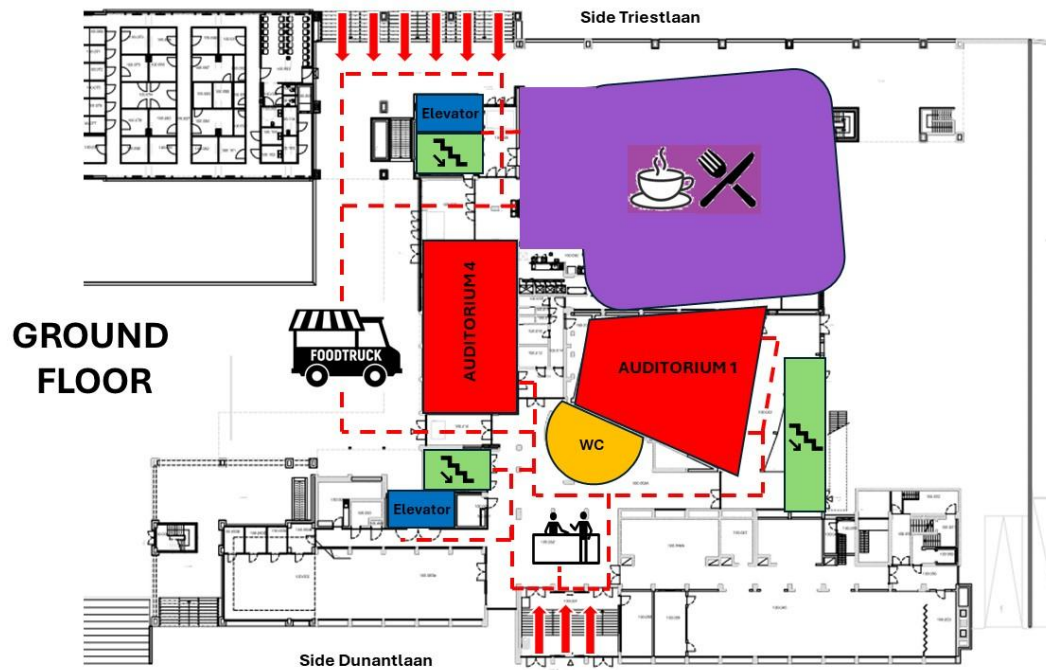
Campus Dunant,
Henri Dunantlaan, 2
9000, Ghent,
Belgium



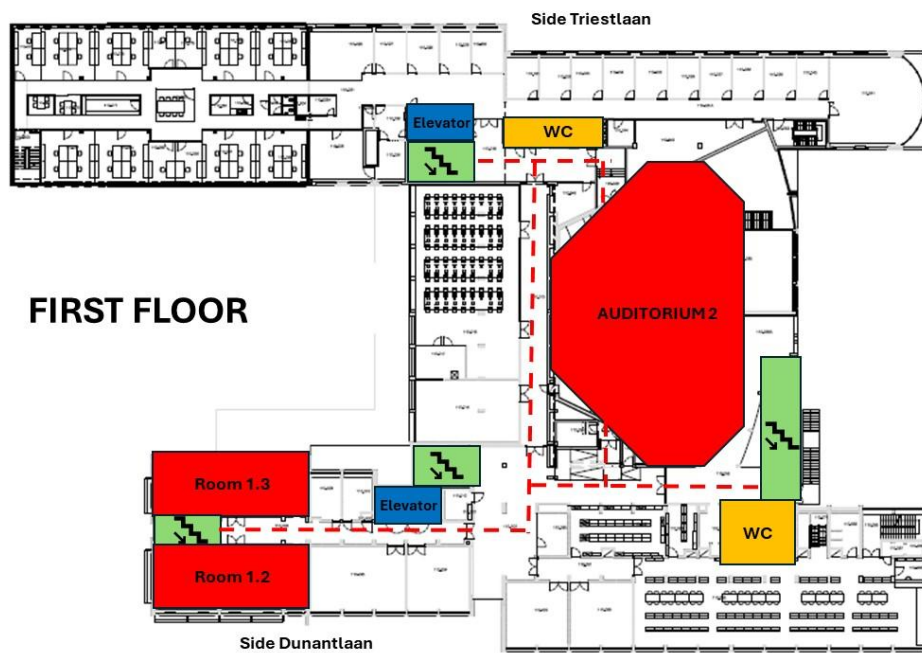
The lectures are scheduled across different lecture halls. Keynote Lectures will be held on the first floor in Auditorium 2. Symposia, workshops, and oral talks will take place in Auditorium 1 and 4 (on the ground floor), Leslokaal 1.2 and 1.3 (on the first floor), and Leslokaal 3.2 and 3.3 (on the third floor). Coffee and lunch will be served at the university cafeteria and the open-air square on the ground floor. Look for signs within the building to easily navigate to the appropriate lecture halls.

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

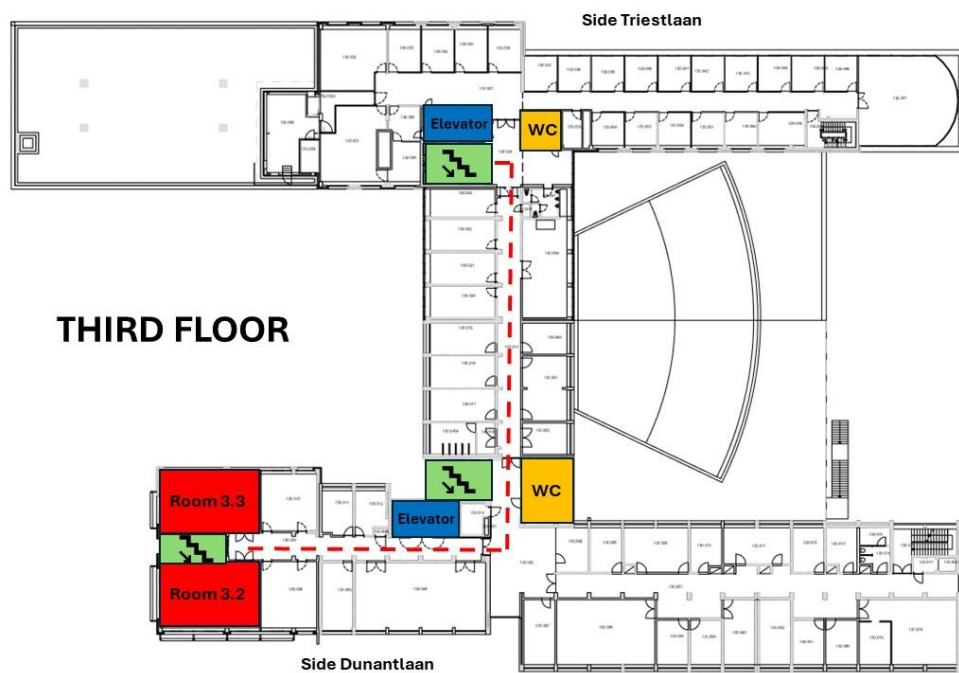
Ground floor (campus Dunantlaan 2)



First level (campus Dunantlaan 2)



Third level (campus Dunantlaan 2)



Travel to Ghent

We strongly encourage participants to choose sustainable travel options when journeying to Ghent. Ghent is only a short train ride away from the international station of Brussels Midi/Zuid. From there, you have direct connections to various European destinations including London, several cities in France, the Netherlands, Germany and Luxemburg. Additionally, there's even a night train to Vienna and Berlin.

For those arriving by plane, the primary airport in Belgium is Brussels Airport Zaventem (not to be confused with Brussels South Charleroi Airport, which is about 50 km away from Brussels). You can take a direct train from there, reaching Ghent Sint-Pieters station in 30 minutes.

There are 4 direct trains/hour from Brussels South (Bruxelles Midi = Brussel Zuid), with departure roughly every 15 minutes.



Public transportation in Ghent

An easily accessible tram stop, “Bernard Spaelaan”, is just a 5-minute walk away from the faculty and links to diverse destinations in the city center as well as the Ghent Sint-Pieters train station. The trams stopping at this tram stop are T1, T3 and T4. Additionally, several bus stops are conveniently located near the faculty. You can use the «[De Lijn routeplanner](#)» to plan your route.

Conference name badges

The badge pick-up is possible on Wednesday May 22d at the reception desk (entrance Henri Dunantlaan, 2, 9000, Ghent) from 10AM until 5PM, and then at the reception between 6PM and 9PM. The registration desk will also be open on Thursday 23rd and Friday 24th at the conference venue. The registration desk is located in front of the main entrance located at Henri Dunantlaan, 2 (see map below). Outside of these times, please send an email to escan2024@ugent.be to schedule an individual meeting with our staff.

Pre-registration for the conference is required. 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 St. Peter’s Abbey, this will be indicated on your badge. You will also receive tickets for the lunch, please do not lose them!

Breastfeeding

There is a silent room and a first-aid room that can be used for breastfeeding in the building. Please ask our volunteers to show you where those rooms are located.

Internet access

The campus has access to WIFI via eduroam.

There is also a specific WiFi account to which you can connect:

Login: **guestEscan**

Password: **Jar5v4pb**

Social media

You can follow us on twitter: @escan2024

Don't hesitate to tag us during the conference!

Use the hashtag: #ESCAN2024

Reusable water bottles

You will receive a reusable water bottle to use during the conference. There are several spots in the faculty building where you can fill them in with fresh water, in addition to during the coffee breaks. You can take the bottle with you and re-use it at home or bring it back to the registration desk. This will prevent a significant amount of trash!

Recycling system in Belgium

Belgium has one of the most efficient and comprehensive waste management and recycling systems in the world. The system is largely built around the use of color-coded bags and containers, each designated for specific types of waste. Please pay attention to correctly use the many trash bins in the building. The trash bins in the building are color coded.

COLOR	TYPE OF WASTE	WHAT IS ALLOWED ?
BLACK	General waste	Non-recyclable waste (not: sharp objects, batteries, medicine, needles)
BLUE	PMD: Plastic, metal and drinking cartons	Plastics: Bottles, vials, dishes, trays, pots, tubes, bags, and beverage capsules Metals: beverages and food cans, spray cans, bottle caps, and aluminum trays, dishes, and lids
GREEN	Organic waste	Food waste and organic waste
YELLOW	Paper	Newspaper and magazines, printing paper, paper, and cardboard packaging (not: dirty and greasy paper)

Presentation guidelines

To ensure smooth transitions between talks, please bring your presentations on a USB stick and come to the allocated room in the morning. There are PCs available in each room, equipped with PowerPoint. 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.

TUTORIALS

Each tutorial will last either 1h30 or 3 hours with a short break in the middle and will include between 1 and 3 speakers. The duration and organization of each tutorial is determined by the tutorial organizers.

SYMPOSIA

Symposia will last 90 minutes and will be composed of 3, 4 or 5 speakers. 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.

SINGLE PRESENTATIONS - ORAL TALK

Each oral presentation will last a maximum of 15 minutes followed by 3 minutes of questions and will include a single speaker. As the time schedule is tight, we ask you to not exceed the suggested talk duration. During each oral presentation session, the chair of each oral session or 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.

SINGLE PRESENTATIONS - POSTER

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

Please note the ID number associated with your poster in the online 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!

You can mount your poster during the first coffee break, the day of your poster session. Attention, on Thursday 23rd, poster boards will only arrive around 10 AM. Please remove the poster before the end of the day, as the space is needed for the next poster session presenters.

Please be present with your poster during the poster session.

SOCIAL EVENTS

Welcome Reception

The conference will be opened with a welcome reception on Wednesday May 22nd, starting from 18h00. The reception will take place in the grand halls of the Opera! Vegetarian food and drinks will be served, and this is included in the conference fee.



Social event for PhD & Postdocs

A social event is organized jointly by ESCAN junior board members and local PhD and postdoctoral researchers. The event will take place at 't Postje: a bar in the city center (KORENMARKT 22, 9000 Ghent).



Gala dinner

On Friday May 24th, there is an optional social event: dinner at a wonderful location in Ghent: the St. Peter's Abbey, with its luscious abbey gardens. Drinks and bites will be served, followed by a delicious and fully vegetarian three-course dinner with accompanying drinks. As the space was limited, participation had to be indicated during the registration procedure. Only registered attendees will be able to come.



CODE OF CONDUCT

- ESCAN conferences, meetings and events are professional scientific meetings that provide a respectful, harassment-free and inclusive environment for all participants, regardless of gender identity, sexual orientation, disability, appearance, ethnicity, race, national origin, age or religion.
- Harassment in any form is not tolerated at the ESCAN conference, or other meetings organized by the Society. Participants are encouraged to report any observed or experienced harassment by emailing escan2024@ugent.be
- Any audio recording, or filming of presentations at the conference, including of scientific posters is not acceptable without the expressed consent of the presenter.
- Mobile phones, tablets, computers, and other electronic devices must be set to silent mode throughout all scientific sessions of the Conference.
- Smoking is prohibited inside the entire congress center, except in designated smoking areas where applicable.
- Where alcoholic beverages are available in the context of the Conference, participants are expected to drink responsibly. Individuals that are visibly under the influence of alcohol or other legal or illegal substances will be escorted from the Conference venue and will not be allowed re-entry.
- All data and scientific research that is presented at the ESCAN conference and other meetings shall be based on original research findings that have been derived from procedures and experiments that adhere to the accepted guidelines for good ethical and experimental research conduct.
- The conference organizers/ESCAN reserve the right to take any action as deemed necessary as a consequence of any breach of the present Code of Conduct. This includes reporting to host institutions and permanent removal of ESCAN credentials.

For the full form of the Code of Conduct see [ESCAN \(escaneurosci.eu\)](https://escaneurosci.eu).

PROGRAM AT A GLANCE

ESCAN 2024 - Program at a glance

Wednesday, May 22nd 2024

12:00pm-3:00pm	Tutorial 3: Beyond pairwise correlations: an introduction to higher order statistical interactions and their application in cognitive and affective neuroscience Location: Auditorium 2	Tutorial 2: Normative modelling for affective and cognitive neuroscience: applications and a hands-on tutorial Location: Auditorium 4	Pre-conference meeting Toward Dynamic Social Cognition and Affect: The role of the Cerebellum and Neocortex (until 5:30pm) Location: Auditorium 1	Tutorial 1: Broadening Horizons in Neuroscience: Engaging Non-WEIRD Populations in Field Research (only starts at 1.30!) Location: Leslokaal 1.2	Tutorial 4: Using functional near-infrared spectroscopy for real world neuroscience and social neuroscience Location: Leslokaal 1.3	Tutorial 5: Introducing DuckSoup, a platform to perform social interaction experiments online while manipulating participants' voice and face. Location: Leslokaal 3.2
3:30pm-6:30pm		Tutorial 6: Introduction to psychophysiological modelling Location: Auditorium 4		Tutorial 7: Real-time functional Magnetic Resonance Imaging & Neurofeedback Location: Leslokaal 1.2	Tutorial 8: Use of functional near-infrared spectroscopy among infant samples (until 5pm) Location: Leslokaal 1.3	Tutorial 9: Thinking differently: Practical guidance for research and allyship with neurodivergent populations Location: Leslokaal 3.2
7:00pm - 10:00pm	Reception Location: Opera					

Thursday, May 23rd 2024

9:00am-10:00am	Keynote lecture 1 : Karin Roelofs Location: Auditorium 2					
10:00am-10:30am	Coffee break					
10:30am-12:00pm	Symposium 1: Opioidergic and dopaminergic modulation of reward processing and decision-making: insights from pharmacological studies in healthy individuals Location: Auditorium 2	Symposium 2: Assessing socio-emotional sensitivity across various modalities, developmental stages, and clinical populations using frequency-tagging electroencephalography Location: Auditorium 4	Symposium 3: Interoception: From fundamental research to clinical applications Location: Auditorium 1	Symposium 4: Loneliness and mental health: neurocognitive mechanisms and interventions Location: Leslokaal 1.2	Symposium 5: The power of social influence on decision-making, and what it takes to say 'No' Location: Leslokaal 1.3	Symposium 6: Novel approaches to study self-other distinction in different domains and in both typically developed and clinical populations Location: Leslokaal 3.2
12:00pm-2:00pm	Lunch break + Poster Session 1 Location: Cafeteria					Biopac Presentation Location: Auditorium 4
2:00pm-3:30pm	Symposium 7: The Drive to Survive: A new look at cognitive and neural mechanisms that support successful avoidance. Location: Auditorium 2	Symposium 8: Cracking the code of the social cognition of face and voice with the CLEESE Python toolbox Location: Auditorium 4	Symposium 9: Interoception: From the Cradle to the Clinic Location: Auditorium 1	Symposium 10: Virtual reality as a tool to study threat responses in humans Location: Leslokaal 1.2	Symposium 11: The crossroads of conflict: Modulating decision-making, inhibitory control, and their neural signatures in social, moral, and intertemporal scenarios Location: Leslokaal 1.3	Symposium 12: From self-priority to mentalising about others: New insights in experimental, clinical, psychopharmacological and neuroimaging research. Location: Leslokaal 3.2
3:30pm-4:00pm	Coffee break					
4:00pm-5:30pm	Oral talks 1: Social interactions Location: Auditorium 2	Oral talks 2: Mentalizing Location: Auditorium 4	Oral talks 3: Emotion & Attention Location: Auditorium 1	Oral talks 4: Self-Other Location: Leslokaal 1.2	Oral talks 5: Cognitive control Location: Leslokaal 1.3	Oral talks 6: Autism Location: Leslokaal 3.2
5:30pm-7:00pm	Symposium 13: Embodied Emotions: Exploring the Dynamic Interplay of Bodily Sensations and Feelings Location: Auditorium 2	Symposium 14: Enhance associative neural plasticity through innovative protocol of non-invasive brain stimulation: cortico-cortical paired associative stimulation Location: Auditorium 4	Symposium 15: Recent developments in the Social and Emotional cerebellum Location: Auditorium 1	Symposium 16: Biopsychosocial Perspectives on Stress: Indicators, Consequences, and Interventions Location: Leslokaal 1.2	Symposium 17: Neurocomputational Representations of Learning Behavior in Social Interactions. Location: Leslokaal 1.3	Symposium 18: Decoding mental states and predicting phenotypes using brain signatures: current advances and challenges Location: Leslokaal 3.2
7:00pm-	Junior social event					SIG social neuroscience
8:00pm -	Location: 't Postje			Location: Hallway outside Auditorium 2		

Friday, May 24th 2024

9:00am-10:00am	Keynote lecture 2: Soyoung Park Location: Auditorium 2					
10:00am-10:30am	Coffee break					
10:30am-12:00pm	Symposium 19: Gut-Brain Interaction shaping decisions Location: Auditorium 2	Symposium 20: How the way we move shapes social perception and interaction Location: Auditorium 4	Symposium 21: The formation and modulation of empathy in the brain Location: Auditorium 1	Symposium 22: Neurobehavioral insights through cognitive and affective tasks in psychiatric patients receiving deep brain stimulation Location: Leslokaal 1.2	Symposium 23: Exploring complex brain mechanisms underlying maladaptive emotion regulation through advanced neuroscience techniques Location: Leslokaal 1.3	Symposium 24: Representing Outgroup Minds Location: Leslokaal 3.2
12:00pm-2:00pm	Lunch break + Poster Session 2 Location: Cafeteria					Biopac Presentation Location: Auditorium 4
2:00pm-3:30pm	Oral talks 7: Stress & Anxiety Location: Auditorium 2	Oral talks 8: Agency, Body, and Touch Location: Auditorium 4	Oral talks 9: Emotion I Location: Auditorium 1	Oral talks 10: Social Influence Location: Leslokaal 1.2	Oral talks 11: Decision making I Location: Leslokaal 1.3	Oral talks 12: Interoception Location: Leslokaal 3.2
3:30pm-4:00pm	Coffee break					
4:00pm-5:00pm	Young Investigator Awards: Jennifer Murphy & Simone Battaglia Location: Auditorium 2					
5:00pm-6:30pm	Symposium 25: Artificial agents as tools to explore the (human) Self Location: Auditorium 2	Symposium 26: The neurochemistry of motivation: a computational lens to understand psychopathology. Location: Auditorium 4	Symposium 27: Modulatory effects of emotion on attention: recent contributions from human neurophysiology Location: Auditorium 1	Symposium 28: Navigating psychosocial stress: understanding its impact and exploring possible pathways to well-being Location: Leslokaal 1.2	Symposium 29: Touching perspectives: A multidisciplinary exploration of vicarious touch and social interaction across diverse populations and techniques Location: Leslokaal 1.3	Symposium 30: New trends in political neuroscience Location: Leslokaal 3.2
7:00pm - 12:00am	Conference Dinner Location: St. Peter's Abbey					

Saturday, May 25th 2024

9:00am-10:00am	Keynote lecture 3: Salvatore Aglioti Location: Auditorium 2					
10:00am-10:30am	Coffee break					
10:30am-12:00pm	Symposium 31: Social and bodily foundations of the self Location: Auditorium 2	Symposium 32: Understanding persuasive communication using brain responses Location: Auditorium 4	Symposium 33: Effects of fluctuating female sex hormones on neurocognitive and affective functioning Location: Auditorium 1	Symposium 34: Exploring the effects of stress on social decision-making and learning Location: Leslokaal 1.2	Oral talks 13: Reward processing Location: Leslokaal 1.3	Oral talks 14: Imitation & Coordination Location: Leslokaal 3.2
12:00pm-1:00pm	ESCAN General Assembly Location: Auditorium 2					
1:00pm-3:00pm	Lunch break + Poster Session 3 Location: Cafeteria					
3:00pm-4:30pm	Oral talks 15: Social Support & Stress Location: Auditorium 2	Oral talks 16: Motor processing Location: Auditorium 4	Oral talks 17: Emotion II Location: Auditorium 1	Oral talks 18: Interpersonal Synchrony Location: Leslokaal 1.2	Oral talks 19: Decision making II Location: Leslokaal 1.3	Oral talks 20: Empathy Location: Leslokaal 3.2
4:30pm-5:00pm	Prices & Closing Location: Auditorium 2					

KEYNOTE SPEAKERS

Keynote Karin Roelofs (May 23rd, 9 am – 10 am)

Donders Institute for Brain Cognition and Behavior, Radboud University, Nijmegen, the Netherlands

Title: Human defensive reactions and their role in approach-avoidance decision making

Behavioural scientists often assume that automatic defensive threat reactions, while essential in explaining animal behavior, only have limited value when it comes to understanding human behavior. There is, however, increasing evidence that defensive reactions, such as freezing, have an impact on subsequent approach-avoidance decisions under acute threat in humans. Understanding the mechanisms that drive such decisions is particularly relevant for patients with anxiety disorders, whose persistent avoidance is key to the maintenance of their anxiety. In recent years, computational psychiatry has made substantial progress formalizing the mechanisms through which we make (mal)adaptive decisions. However, most current models ignore the transient psychophysiological state of the decision maker. Here, I argue that the balance between para-sympathetic and sympathetic activity is instrumental in driving the psychophysiological state of freezing, and that it influences approach-avoidance decisions under acute threat in different ways. To illustrate, I first explore the effects of freezing on different kinds of human action decisions under threat. Next, I discuss recent translational (rodent-human) work that has helped to characterize the neural mechanisms implicated in animal and human defensive freezing. Finally, through two prospective longitudinal studies, I show that individual differences in susceptibility to freezing are predictive of the development of anxiety symptoms. Overall, this work suggests that defensive threat reactions and associated psychophysiological states not only affect acute decision making, but also predict long-term symptom development. As such, these factors have great importance for resilience research, and should constitute an integral part of any theory of human decision making.

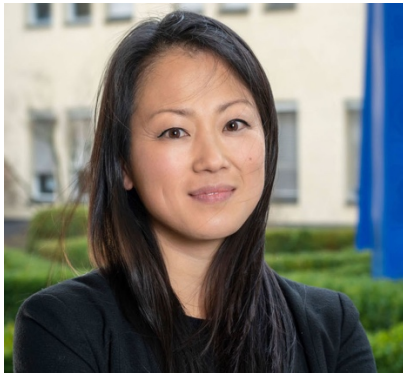


Keynote Soyoung Park (May 24th, 9 am – 10 am)

Charité – Universitätsmedizin Berlin (Neuroscience Research Center) and German Institute for Human Nutrition (DIfE – Leibniz Alliances), Germany

Title: *Towards a holistic approach to human decision making*

What drives us to trust someone we just met? Did we eat spaghetti for lunch because we saw our colleague eat spaghetti? Can our breakfast impact our decisions throughout the day? I propose to view decision neuroscience as a highly interactive interdisciplinary research field, since we need to continuously integrate internal and external information to make and modulate decisions. On the one hand, I will present how decisions emerge as a result of intense body-brain interactions, exemplified by how the food we have eaten can change our decisions via metabolic pathways. On the other hand, our decisions are shaped by the constant integration of social information around us. In this talk, I will present a series of recent studies from my lab in which we shed light on the importance of the holistic nature of decision neuroscience, including metabolic and social aspects.



Keynote Salvatore Aglioti (May 25th, 9 am – 10 am)

Sapienza University of Rome and cln2s@sapienza, Istituto Italiano di Tecnologia, Italy & Fondazione Santa Lucia, IRCCS, Italy

Title: *Embodied morality: influence of exteroceptive and interoceptive bodily cues on moral decisions in real and virtual interactions*

Embodied cognition theories posit that even seemingly abstract processes such as language syntax may be biased by the sensorimotor signals through which bodily self-consciousness -our sense of owning a body (ownership) and being the author of actions (agency)- is built and maintained. Adopting an embodied morality framework, I will focus on our recent research based on innovative technologies (e.g., ingestible devices that can transmit guts signals during cognitive and emotional tasks) and established experimental paradigms (e.g., physiological recording of autonomic nervous activity) and aimed at testing whether strengthening or weakening participants' sense of ownership and agency over artificial agents influence dishonesty in real and virtual interactions. This approach offers insights into how body-related variables influence moral decisions at behavioral, physiological, and neural levels. Specifically, I will discuss the impact of exteroceptive (e.g., the external features of a virtual body such as its physical appearance) and interoceptive cues (e.g., the internal bodily states shaped by cardiac, or thermal signals) on modulating bodily-self consciousness and its relation with (dis)honest decisions. Additionally, I will examine the contribution of less explored, deep body signals (e.g. respiratory and gastro-intestinal) supposedly involved in homeostatic regulation and allostatic brain-body interactions and how these seemingly low-level variables modulate higher-order functions like corporeal awareness, complex emotions and moral decision making.



YOUNG INVESTIGATOR AWARDS

Simone Battaglia

Title: *Pushing the boundaries of emotional fear learning in the human brain*

Emotional fear learning is a crucial resource for living beings, protecting them from dangerous or deathly situations. Its relevance extends beyond innately fearful stimuli, also allowing for the creation of rapid associations between neutral stimuli and harmful events, laying the basis for adaptation in an evolving environment. My research comprehensively analyzed the neurobiological and functional bases of emotional fear learning in humans, employing non-invasive brain stimulation techniques and psychophysiological indices. In particular, I showed that interference with the dorsolateral prefrontal cortex during the memory consolidation phase blocks memory formation. Similarly, its disruption during the reconsolidation phase alters subsequent fear recall, suggesting its fundamental role even in these processes. Moreover, the prefrontal cortex was shown to be crucial for acquiring new fear memory in a study with both healthy individuals and patients with acquired dorsolateral cortex lesions, highlighting that patients display an inability to show psychophysiological responses reflecting fear acquisition. Finally, this led my research to investigate the anatomical-functional interplay between the prefrontal cortex and the autonomic nervous system in threatening situations. In summary, my work investigated the neural underpinnings of emotional fear learning in humans, which may influence the future development of novel therapeutic strategies for anxiety-related disorders.



Jennifer Murphy

Title: *Interoception in Anxiety - what is going on?*

Anxiety is often considered the prototypical disorder of interoception, with various theories suggesting maladaptive processing and greater sensitivity to bodily signals in anxiety. However, results regarding the relationship between anxiety and aspects of interoception are mixed. In this talk, I will present novel work examining the relationship between multiple facets of interoception and anxiety using newly developed measures that attempt to overcome the limitations of existing tools. I will argue that while evidence does suggest maladaptive processing of interoceptive signals in anxiety, more work considering the influence of state effects is needed to fully understand interoceptive processing in anxiety and the suitability of interoceptive interventions.





May 22nd

**PRE-CONFERENCE
EVENT**

**Toward Dynamic Social
Cognition and Affect: The role
of the Cerebellum and
Neocortex**

Wednesday, May 22nd 2024 // 12:00pm – 5:30pm

Location: Auditorium 1

Toward Dynamic Social Cognition and Affect: The role of the Cerebellum and Neocortex

Almost every social and affective neuroscience conference focusses on the neocortex and static aspects of social cognition and emotion. For too long, social neuroscience used and evaluated material depicting relative static social behaviors, with little regard for the rich dynamic nature of social action and emotional experiences. Dynamic analysis is important, because the brain is constantly trying to predict the physical and social world, in order to engage fluently in the next stage of social and non-social behavior. Increasing evidence points to the importance of the cerebellum in dynamic social and affective functions. Dynamic analysis is also important because social and emotional behaviors often involve human interaction, with give and take from both parties, with is impossible without anticipating what is coming next and making quick corrective social and emotional adaptations if expectations are not met. Without the cerebellum, our social and emotional behavior would be slumpy and uncoordinated, with little awareness of what comes next, and thus replete with many social and emotional errors. An example of such behavior is autism, as there is converging evidence that a sizeable part of this pathology originates from deficiencies in the cerebellum. At this pre-conference, we welcome all social and affective neuroscientists to promote their research, but, for the first time, we let a dynamic analysis and the role of the cerebellum take center stage.

12:00-12:30: Welcome Desk

12:20-12:30: Opening statement

12:30-13:20: Prof. Matthias Schurz, University of Innsbruck, Germany (50 mins): **The neurofunctional organization of social cognition and empathy: An interactive brain networks perspective**

13:20-14:10: Prof. Catherine Stoodley, American University, US (50 mins): **Cerebellar modulation of social learning and social networks**

14:10-14:40: Prof. Zaira Cattaneo, University of Bergamo, Italy (30 mins): **Cerebellum and social cognition: insights from TMS in the healthy brain**

14:40-15:40: Coffee break with posters (60 mins)

15:40-16:10: Prof. Cosimo Urgesi, University of Udine, Udine, Italy (30 mins): **Detection and treatment of social prediction in patients with cerebellar alterations**

16:10-17:00: Prof. Frank Van Overwalle, VUB, Belgium (50 mins): **The social cerebellum: New insights and developments**

17:00-17:30: General discussion with the speakers and audience (30 mins)



May 22nd

TUTORIALS



Wednesday, May 22nd 2024 // 13:30pm – 3:00pm

Location: Leslokaal 1.2

Tutorial 1

Broadening Horizons in Neuroscience: Engaging Non-WEIRD Populations in Field Research

Emilie Caspar, Elodie Kox

The predominance of Western, Educated, Industrialized, Rich, and Democratic (WEIRD) populations in neuroscience research has long been a subject of concern, limiting the generalizability of findings. This tutorial aims to guide researchers on how to extend their studies beyond WEIRD-centric paradigms, focusing on conducting neuroscience research in diverse and non-traditional settings. We will explore methodologies and considerations for working with unique populations such as former genocide perpetrators and victims in Cambodia and Rwanda, inmates, and military personnel.

The session will open with a discussion on the limitations of WEIRD-centric neuroscience. We will explore how over-reliance on WEIRD samples limits our understanding of the brain and behavior, potentially leading to skewed conclusions. This introduction sets the stage for a deep dive into practical methodologies for conducting field neuroscience research. We will outline strategies to overcome logistical, ethical, and methodological challenges, highlighting the need for cultural sensitivity, experimental protocol adaptation, and the management of unique constraints encountered in non-traditional research settings.

Studies from Cambodia and Rwanda will illustrate the profound implications of studying neurological and psychological aspects in the context of trauma and resilience among genocide survivors and perpetrators. Additionally, we will discuss research with inmates and military personnel, showcasing the varied neurological landscapes that these groups present.

This tutorial is targeted at neuroscience researchers and students seeking to broaden their research horizons. It offers insights into the practicalities and complexities of field neuroscience, underscoring the value of including diverse populations in research. Participants will gain an understanding of the nuances involved in adapting neuroscience research for various non-WEIRD groups, emphasizing the rich, yet untapped, potential these populations hold for advancing our understanding of the human brain.

The aim is to empower attendees with knowledge and strategies to conduct inclusive, globally representative neuroscience research, moving beyond traditional laboratory confines and contributing to a more comprehensive understanding of the brain across different cultures and life experiences.

Wednesday, May 22nd 2024 // 12:00pm - 3:00pm

Location: Auditorium 4
Tutorial 2

Normative modelling for affective and cognitive neuroscience: applications and a hands-on tutorial (registration required)

Hannah Savage

To better understand how the brain relates to behaviour it is essential to move our focus from the group-level to studying individual differences and consider such processes within the context of multiple sources of heterogeneity. Normative modelling is a statistical framework that provides statistical inference at the level of each subject with respect to a normative reference model. This method highlights variation within populations, in terms of the mapping between two or more variables, such as a biological variable (e.g. volume of, or extent of functional activation within a brain region) and other measures of interest (e.g. a demographic variable such as age, an affective task outcome variable, or clinically relevant measure/scores). This framework has previously been employed to demonstrate variation in brain structure and functional activity within large healthy populations (Rutherford et al., 2022, Savage et al., 2023 in prep), and to characterize historically overlooked heterogeneity within clinical populations (Autism: Zabihi et al. 2019, Schizophrenia and Bipolar Disorder: Wolfers et al. 2018).

With demonstrated applications across the domains of neuroimaging [structural, functional and diffusion] and cognition (Rutherford et al., 2022, Savage et al., 2023, Kjelkenes et al., 2023), and great potential for extensions into psychophysiology and affective psychometrics, we hope this tutorial will inspire attendees to delve deep into their data and consider applying this method to understand and embrace the heterogeneity within their affective and cognitive topic areas.

In this tutorial participants will first get an overview of normative modelling and its current applications in an introductory lecture. They will then use Google Colab Notebooks to create normative models using brain imaging data, learn how to interpret and visualize the outputs of the normative models, and use the deviation scores to predict schizophrenia diagnosis.

Location: Auditorium 2
Tutorial 3

Beyond pairwise correlations: an introduction to higher order statistical interactions and their application in cognitive and affective neuroscience

Daniele Marinazzo, Fernando Rosas

The functioning of complex systems (i.e. the brain, and many others) depends on the interaction between different units; crucially, the resulting dynamics is different from the sum of the dynamics of the parts.

While all this is known, the methods used to assess these interactions are mostly pairwise, i.e., they focus on the dependency between item A and item B. This dyadic representation is also reflected in the representation of interactions as pairwise graphs (or networks)

It is now firmly acknowledged that many real-world systems display high-order (polyadic) interactions, i.e. interactions involving more than two network nodes. Thus, in these systems the network behavior is integrated at different hierarchical levels and time scales. This occurs also in cognitive sciences, where it is important to distinguish between brain regions or organ systems that interact as a pair, or as a part of a more complex structure, to produce the observed dynamics. For instance, brain dynamics display mesoscopic or macroscopic behaviors requiring multiple-unit interactions to be predicted accurately, and cardiovascular interactions may arise autonomously from self-sustained mechanisms or as a result of the effects of respiration on the measured dynamics.

Considering higher-order statistical interactions we would be able to address statistical issues (those posed by conditioning on colliders or to the individuation of latent factors), as well as fundamental ones, by pinning complex behaviors and experimental manipulations onto groups of variables sharing common information on the state of the system, and by identifying this information as synergistic or redundant.

Information theory offers a powerful and versatile framework; notably, it allows detecting high-order interactions that determine the joint informational role of a group of variables. In this tutorial I will present ideas, tools and algorithms that have been implemented and validated in the last years in a robust and flexible framework, and then showcase its applications to neurosciences and network physiology.

Location: Leslokaal 1.3
Tutorial 4

Using functional near-infrared spectroscopy for real world neuroscience and social neuroscience

Antonia Hamilton, Chiara Bulgarelli, Isla Jones, Sara De Felice

Functional near-infrared spectroscopy (fNIRS) is a growing neuroimaging method with particular relevance to research in social neuroscience and real-world neuroscience. This tutorial aims to provide an introduction to the method for researchers who want to start using fNIRS. The first talk will introduce the basic principles of fNIRS and explain what different types of equipment can measure. It will describe how fNIRS enables a wide range of experimental designs in a diverse population of participants including infants, toddlers, patients with any medical condition and healthy adults. The different software packages available for fNIRS data analysis will also be described. The second talk will describe factors that are essential to consider in setting up an fNIRS experiment, with a focus on what is different from fMRI and EEG methods. This includes the requirement to capture and measure physiological signals (breathing and heartrate), and the agreed best-practices in the fNIRS field. Data quality assurance will also be described here.

After a coffee break, there will be a demo of fNIRS equipment showing how caps can be placed on the head and capture brain data. The demo will show how to place a cap, capture optode locations and how to ensure that high quality data is collected. The third talk focuses on hyperscanning and describes how fNIRS can be used to measure the coordination between two or more people in a social interaction, and what this data means. The final talk will be a more general discussion that brings together the themes of the workshop and will enable the attendees to engage in a wider conversation. All talks are scheduled to allow plenty of time for questions and discussion. After the workshop, attendees will also be given a list of resources and links to relevant software and hardware to enable them to make a start on their own fNIRS research.

Location: Leslokaal 3.2
Tutorial 5

Introducing DuckSoup, a platform to perform social interaction experiments online while manipulating participants' voice and face.

Pablo Arias Sarah, Jean-Julien Aucouturier, Philippe G. Schyns, Lars Hall

The next frontier in human social cognition research is the ability to study real-life social interactions. This is pivotal because most theories and methodologies of social cognition have been derived from presenting participants with pre-recorded stimuli, rather than studying more realistic interactive situations.

However, it has been remarkably difficult to study how specific factors (e.g. social signals and contexts) causally influence cognitive mechanisms when participants interact. Indeed, paradigms that analyse recorded social interaction datasets can only provide correlational findings. Moreover, manipulating specific factors via digital agents is, at the time of writing, limited by the digital agents' realism (Hadley et al. 2022). To uncover causality in social contexts, researchers need a tool to manipulate specific factors in real-time, during social interactions, and without participants' awareness. These are the aims of DuckSoup, an experimental platform for causal social interaction research, that we have been building for the past 3 years, and that we are introducing in this tutorial.

DuckSoup is an open-source videoconference platform, just as Zoom or Skype, but where researchers can manipulate participants' voice and face in real time using voice and face processing algorithms. This enables researchers to covertly control participant's signals without affecting the naturalness of the interactions. With DuckSoup, researchers can modulate social factors such as a person's smile intensity, or their vocal expressivity, vocal masculinity, dominance, or their visual/auditory background, in any interactive context (e.g. brainstorming, multi-person games, job interviews, etc). This enables (1) collection of massive and synchronized social interaction datasets and (2) making causal inference between parametrically manipulated factors, and subsequent behavioral, neural, and physiological reactions.

We are happy to launch DuckSoup at this year's ESCAN with this tutorial. We will demonstrate how to use DuckSoup to design a social interaction experiment, collect and record video-conference social interaction datasets online, and analyze these recordings with automatic voice, face and semantic analysis techniques—as detailed below.

Location: Auditorium 4
Tutorial 6

Introduction to psychophysiological modelling

Dominik Bach, Juliana Sporrer

Psychophysiological modelling (PsPM) is a technique and software for analysing psychophysiological data time series. This includes pupil dilation, gaze patterns, skin conductance, startle eyeblink EMG, or cardiorespiratory measures.

Like many analysis techniques for these types of data, PsPM seeks to quantify a cognitive (psychological) variable from the observed data, such as arousal, attention, or associative memory. To find relevant, and suppress irrelevant, data features, PsPM employs an explicit forward model. This model specifies how the cognitive variable, at certain points in time, would impact the psychophysiological time series. The values of the cognitive variable constitute the parameters of this model, which are then estimated from the data. On a technical level, the approach shares many similarities with standard analysis techniques for functional neuroimaging data.

PsPM has been shown usable in various applications throughout cognitive and affective neuroscience. In several of these applications, it might provide higher-quality estimates of the underlying cognitive processes than classical (usually peak-scoring) techniques.

This tutorial provides the practical basics of data analysis with the software PsPM. We will go through the steps of a standard workflow, from data import and cleaning to model set-up, estimation, and interpretation. We will provide easy-to-use standard scripts and example data, but participants are also encouraged to bring their own data and ideas.

Location: Leslokaal 1.2
Tutorial 7

Real-time functional Magnetic Resonance Imaging & Neurofeedback

Florian Krause, Michael Luehrs

Real-time functional Magnetic Resonance Imaging (rt-fMRI) allows for the ‘live’ monitoring and analysis of brain activation as it unfolds during an ongoing task. This has opened the door for exciting new adaptive experimental paradigms as well as brain-computer interfaces. One of its most common applications is to implement neurofeedback - a type of biofeedback focusing on physiological signals from the brain – that can be used to train the direct self-regulation of selective brain functions. Not only does this endogenous form of neuromodulation allow for establishing causal relationships between brain function and behaviour, but it also serves as an intervention mechanism in a clinical setting.

In this three-hour tutorial, we will provide a detailed introduction to this methodology as well as the involved technology. We will cover (1) the technical aspects and requirements to implement an rt-fMRI setup at a scanning facility, (2) the methodological aspects of implementing and conducting neurofeedback studies, and (3) the practical considerations for preprocessing and analysing the resulting real-time data. The tutorial will be held in an interactive format that walks participants step-by-step through concrete examples and has ample room for asking questions and having deeper discussions on implementation details and common pitfalls.

Participation in this tutorial is not limited, but requires basic neuroimaging knowledge.

Location: Leslokaal 1.3

Tutorial 8

Use of functional near-infrared spectroscopy among infant samples

Vera Mateus, Livia Campos, Adriana Sampaio

This tutorial presents important topics to consider when planning and executing a research project using functional near-infrared spectroscopy (fNIRS) among infant samples. Preparation for data collection should consider the type(s) of stimuli that will be presented to the infant, as well as strategies to engage the infant and prevent excessive fussiness that could increase attrition rates. Aspects of child development (e.g., muscular tone) should also be considered when planning the setup, including where the infant will be placed during the experiment (e.g., parent's lap, highchair). Another important aspect is cap fit and placement, as infants tend to be upset by head manipulation. Therefore, it is important to consider not only the specific cap available (e.g., assuring appropriate fit to head without over-pressure) but also to provide appropriate training for the team members tasked with (quickly) placing the cap, while also keeping the infant distracted and setting the fNIRS equipment. The quality of the signal is a relevant aspect of every fNIRS study, but infant studies pose additional challenges. Therefore, the setting of the room (e.g., proximity to caregiver), the length of the paradigm (e.g., including the number of trials) and the possibility of breaks (e.g., for a nappy change, breastfeeding), and strategies to ensure infant engagement in the task should be carefully planned. To ensure adequate placing of the cap/optodes throughout the session as well as for later validation of trials, we also recommend the videotaping of all sessions. A step-by-step tutorial – from room setup to trial validation – will be provided to participants.

Location: Leslokaal 3.2
Tutorial 9

Thinking differently: Practical guidance for research and allyship with neurodivergent populations (registration was required)

Lisa Quadt, Jessica Eccles, Sarah Garfinkel

Neurodiversity describes a spectrum of neurological differences in humans, while neurodivergence refers to traditionally diagnostic categories such as autism, attention deficit hyperactivity disorder, dyslexia, and dyspraxia. Neurodivergent individuals think, feel, sense, interact, and behave differently than most people. There are persistent and harmful stereotypes in research, healthcare, and wider society about neurodivergent people, including a lack of empathy, being either a genius or severely disabled, and not being able to fruitfully contribute to society. However, just as most other people, neurodivergent individuals present on a complex spectrum of (dis)ability, challenges, and strengths.

In research contexts, neurodivergent groups are often assumed to be inherently deficient, their wishes and priorities may remain neglected, and research environments are often inaccessible. This is symptomatic of a wider societal hostility that is likely one important contributor to the overrepresentation of physical and mental health issues, and a life expectancy of neurodivergent people that is up to 30 years reduced. Research and healthcare context often pathologize neurodivergent behaviour, with devastating consequences for the wellbeing of this group of people.

In this tutorial, we will offer insight into the world of neurodivergence from a non-pathologizing perspective, in which we assume that neurodivergent people are different but not inherently deficient. We discuss how to shift from the myths of deficiency in the traditional medical model to embracing the merits of the neurodiversity paradigm while acknowledging the numerous and unique challenges neurodivergent people face. We tackle some ethical implications and provide guidance for practical steps that can be taken to ensure best research practices.

As neurodivergent academics and allies, we will also talk about being neurodivergent in academia, how neurodivergent academics at all career stages can take care of themselves, and how we can support our neurodivergent students, mentees, and peers.



May 23rd – 9:00AM – 10:00AM

KEYNOTE TALK



Location: Auditorium 2

Keynote lecture 1

Human defensive reactions and their role in approach-avoidance decision making

Karin Roelofs, Donders Institute for Brain Cognition and Behavior

Radboud University, Nijmegen, the Netherlands

Behavioural scientists often assume that automatic defensive threat reactions, while essential in explaining animal behavior, only have limited value when it comes to understanding human behavior. There is, however, increasing evidence that defensive reactions, such as freezing, have an impact on subsequent approach-avoidance decisions under acute threat in humans. Understanding the mechanisms that drive such decisions is particularly relevant for patients with anxiety disorders, whose persistent avoidance is key to the maintenance of their anxiety. In recent years, computational psychiatry has made substantial progress formalizing the mechanisms through which we make (mal)adaptive decisions. However, most current models ignore the transient psychophysiological state of the decision maker. Here, I argue that the balance between para-sympathetic and sympathetic activity is instrumental in driving the psychophysiological state of freezing, and that it influences approach-avoidance decisions under acute threat in different ways.

To illustrate, I first explore the effects of freezing on different kinds of human action decisions under threat. Next, I discuss recent translational (rodent-human) work that has helped to characterize the neural mechanisms implicated in animal and human defensive freezing.

Finally, through two prospective longitudinal studies, I show that individual differences in susceptibility to freezing are predictive of the development of anxiety symptoms.

Overall, this work suggests that defensive threat reactions and associated psychophysiological states not only affect acute decision making, but also predict long-term symptom development. As such, these factors have great importance for resilience research, and should constitute an integral part of any theory of human decision making.



May 23^d – 10:30pm – 12:00pm

SYMPOSIA

Thursday, May 23rd 2024 // 10:30am - 12:00pm

Location: Auditorium 2
Symposium 1

Opioidergic and dopaminergic modulation of reward processing and decision-making: insights from pharmacological studies in healthy individuals

Claudia Massaccesi, Giorgia Silani, Antoni Rodriguez-Fornells, Marie Eikemo, Alexander Soutschek

The symposium showcases novel evidence of dopaminergic and opioidergic neuromodulation of human reward processing and reward-based decision-making. Although animal models have provided insights into the mechanistic role of these neuromodulators in such processes, animal-to-human translation of findings has proven incredibly challenging. The speakers will present a series of human pharmacological studies examining opioidergic and dopaminergic contributions to reward processing and decision-making across a range of rewarding stimuli (money, food, touch, music). Overall, the symposium will demonstrate how pharmacological manipulations of the healthy human brain can foster our understanding of the neurochemical foundations of human reward.

Talk 1 - Claudia Massaccesi

Opioidergic and dopaminergic regulation of motivational and hedonic neural responses to social and non-social rewards

Extensive evidence from animal research has shown that wanting (the motivation to pursue a reward) and liking (the pleasure associated with its consumption) are mostly regulated by dopaminergic and opioidergic activity in dedicated brain areas. However, less is known about the neuroanatomy of dopaminergic and opioidergic regulation of reward processing in humans, especially when considering different types of rewards (i.e., social and non-social). To fill this gap of knowledge, we combined dopaminergic and opioidergic antagonism (via amisulpride and naltrexone administration) with functional neuroimaging to investigate the neurochemical and neuroanatomical bases of wanting and liking of matched non-social (food) and social (interpersonal touch) rewards, using a randomized, between-subject, placebo-controlled, double-blind design. While at the behavioral level no drug effect was observed, brain activity was modulated by the administered compounds. In particular, opioid antagonism, compared to placebo, reduced activity in the medial orbitofrontal cortex during consumption of the most valued social and non-social rewards. Dopamine antagonism, however, had no clear effects on brain activity in response to reward anticipation. These findings provide insights into the neurobiology of human reward processing and suggest a similar opioidergic regulation of the neural responses to social and non-social reward consumption.

Talk 2 - Antoni Rodriguez-Fornells

Dopamine and opioid modulation of music-elicited reward and motivation

In everyday life humans regularly seek participation in highly complex and pleasurable experiences such as music listening, singing, or playing, that do not seem to have any specific survival advantage. Understanding how the brain decodes music into a pleasant and rewarding experience is a fascinating question. Previous neuroimaging findings showed activation of dopaminergic midbrain-striatal reward-motivation brain networks in music-evoked pleasure. We will be presenting recent evidence from our lab showing to which extent dopaminergic and opioid neurotransmission causally mediates the hedonic experience from music and the motivation to engage in music-related activities. Using two double blind within-subject pharmacological designs we evaluated the modulation of wanting and liking effects during music listening in humans. This research provides intriguing new evidence on how music is decoded into pleasant-rewarding experiences as well as the involvement, and potential interaction, between different neurotransmitter systems in the regulation of wanting and liking reward subcomponents. Overall, these new findings open new intriguing questions for understanding the processing of abstract rewards in humans and their involvement in intrinsic motivated activities.

Talk 3 - Marie Eikemo

Opioid modulation of value-based decision-making and sensitivity to rewarding and aversive stimuli: evidence from an experimental trial with intravenous oxycodone

Opioid agonist drugs have been shown to increase reward sensitivity and fine-tune value-based decision-making in humans. These findings are largely based on moderate per-oral doses that do not produce noticeable side effects. Further, evidence regarding opioid effects on sensitivity to aversive stimuli, such as uncomfortable stimuli and losses, is still lacking. In this placebo-controlled double-blind cross-over study we tested how 63 healthy participants (32 women, mean age=30) performed on reinforcement learning tasks with potential wins and losses following intravenous administration of a moderate dose of the opioid oxycodone (3.21mg/70kg) and saline. The dose was piloted to yield noticeable effects but very few adverse effects. Value-based decision making was assessed using responses from a 4-armed-bandit task where participants gradually learned reward (good/bad) and risk (safe/risky) contingencies. Across three blocks, outcomes were (1) “gains-only”, (2) “losses-only” or (3) mixed outcomes. The proportion of good and risky choices were modeled as a function of the drug condition using mixed effects regression. Contrary to our hypothesis, opioid administration reduced sensitivity to rewards. Interestingly participants were also less sensitive to losses following oxycodone. The blunting of reward and loss sensitivity was significantly more pronounced in men, despite fewer drug side effects compared to women. Opioids also led to more risky choices among the women when all in the “loss-only” condition. The reward learning findings will be discussed together with opioid effects on other measures of hedonic sensitivity such as responses to pleasant and aversive odors and motivation for sweet and salty taste.

Talk 4 - Alexander Soutscheck

A Process Model Account of the Role of Dopamine in Cost-Benefit Decision Making

Dopamine plays a crucial role in motivating goal-directed behavior despite action costs (cost-benefit decision making), but so far there is no consensus on the precise role of dopamine in cost-benefit decision making. Here, we argue that conflicting empirical findings in the literature can best be explained by combining the strengths of two theoretical accounts: dopamine may play a dual role in promoting both the pursuit of psychologically close options (e.g., sooner and safer rewards) and in computing which costs are acceptable for a reward at stake. These two assumptions can be combined in process models of decision making such as the drift diffusion model where dopamine may influence two dissociable components of the decision process, evidence accumulation and starting bias. To provide empirical evidence for this hypothesis, we re-analyzed a previously published data set where intertemporal decisions were made either under the D2 antagonist amisulpride or under placebo by fitting a hierarchical drift diffusion model that distinguishes between dopaminergic effects on the speed of evidence accumulation and the starting point of the accumulation process. Blocking dopaminergic neurotransmission not only strengthened the sensitivity to whether a reward is perceived as worth the delay costs during evidence accumulation (drift rate) but also attenuated the impact of waiting costs on the starting point of the evidence accumulation process (bias). Together, our findings support a process-based account of the role of dopamine for cost-benefit decision making, highlight the potential benefits of process-informed analyses and advance our understanding of dopaminergic contributions to motivation.

*Location: Auditorium 4
Symposium 2*

Assessing socio-emotional sensitivity across various modalities, developmental stages, and clinical populations using frequency-tagging electroencephalography

Bart Boets, Stephanie Van der Donck, Rowena Van den Broeck, Tiffany Tang, Zhiling Qiao, Xena Serifova

Humans are sensitive for the socio-emotional information conveyed by faces, voices, and scenes. Yet, large interindividual variability exists. Here, we explore differences in socio-emotional sensitivity across various (sub)clinical and developmental populations, including autistic children and adults (talk 1), prematurely born infants, toddlers and school-aged children (talk 2), adolescents and young adults exposed to childhood adversity (talk 3), and adults with obsessive-compulsive disorder (talk 4). Throughout all these studies, we apply frequency-tagging EEG. This neuroimaging approach yields many advantages: it is fast, implicit, objective, directly quantifiable, and robust at the individual subject-level, making it ideal for clinical or vulnerable populations.

Talk 1 - Stephanie Van der Donck & Tiffany Tang

Quantifying neural sensitivity for nonverbal socio-communicative cues in neurotypical and autistic individuals using frequency-tagging EEG

Introduction: A crucial skill for successful human social interaction is the ability to quickly and accurately process social information, both from faces and voices. The neural mechanisms underlying these processes may be impaired in individuals with autism spectrum disorder (ASD), which in turn may be related to social difficulties.

Methods: Throughout a series of studies we applied frequency-tagging electroencephalography (FT-EEG) to quantify the neural sensitivity for subtle socio-communicative cues in autistic children and adults, and compared their brain responses to those of matched neurotypical controls.

Results: Findings show an overall reduced neural tuning towards visual and auditory social stimuli in autistic children and adults. Autistic children show reduced neural sensitivity to brief changes in facial identity and facial expression compared to non-autistic children. Yet, in adults, the neural sensitivity to these socio-communicative cues, as well as the neural sensitivity to rapidly detect differences in vocal expressions, does not significantly differ between autistic and non-autistic participants.

Conclusion: Taken together, FT-EEG allows to objectively quantify individual variation in neural sensitivity to emotional and neutral (visual and auditory) stimuli in neurotypical and autistic individuals. We will discuss developmental patterns, contrasting findings in children and adults.

Talk 2 - Rowena Van den Broeck

Exploring frequency-tagging EEG as a tool to investigate voice and face perception in preterm born populations

Preterm birth (gestational age < 37 weeks) is associated with a higher prevalence of atypical socio-emotional and cognitive development. A preterm behavioral phenotype has been put forward, characterized by difficulties in emotion recognition, social interaction, attention, and anxiety. Consistent with this phenotype, preterm birth has been linked to an increased prevalence of psychiatric disorders such as autism spectrum disorder. However, there is much heterogeneity between preterm children, with many showing sub-clinical symptoms and traits. Previous research has suggested that preterm children show reduced social preferential gaze behavior and alterations in emotional expression processing. However, research on socio-affective development is inconsistent, and often uses behavioral measures or questionnaires. This necessitates the introduction of more sensitive and objective measures. Using different frequency-tagging EEG paradigms, we were able to pinpoint subtle differences in the social and affective functioning of preterm children across different age groups. The crucial role of (correct) visual face processing for social functioning is reflected in our paradigms as various aspects of visual face processing are investigated: social orienting towards faces as opposed to houses, facial expression and identity discrimination with familiar (i.e., mother) and/or unfamiliar faces. This research can elucidate the socio-emotional and communicative development of preterm children, aiding in the early identification of children who may be susceptible to psychopathology or subtle socio-emotional difficulties.

Talk 3 - Zhiling Qiao

Neural socio-emotional processing in adolescents and young adults exposed to childhood adversity

Introduction: Mechanistic studies linking childhood adversity with the risk for psychopathology emphasize a threat-related information processing bias.

Methods: 120 adolescents (12 – 16 years), recruited from the general population, and 98 young adults (16 – 24 years), selected specifically based on childhood adversity and the presence of (sub)clinical symptoms of anxiety, depression, and psychosis, completed an oddball and a multi-input frequency-tagging EEG paradigm to assess processing of facial expressions (neutral, happy and angry faces) and more complex natural scenes (negative and neutral scenes with social or non-social content).

Results: Across both populations, individual differences in the extent of experienced childhood adversity (particularly early threat experiences) were associated with reduced angry-neutral-face discrimination and enhanced happy-neutral-face discrimination. This response pattern was further observed in processing of more complex scenes with social content, but not in those with non-social content, in young adults. Individual variability in severity of symptomatology did not modulate these neural response patterns.

Conclusion: Childhood adversity, particularly early threat experiences, is associated with reduced threat-safety discrimination in two independent populations.

Talk 4 - Xena Serifova

A frequency-tagging EEG based approach to assess obsessive-compulsive symptom severity

Introduction: Obsessive-Compulsive Disorder (OCD) is a debilitating psychiatric condition, characterized by anxiety-provoking obsessions and time-consuming compulsions, affecting 2-3% of the population. The clinical expression and severity of OCD are highly heterogeneous, and current assessment tools rely heavily on subjective patient reports, making assessment and diagnosis challenging. There is no objective biomarker to determine the severity of OCD-related symptoms, which complicates treatment choice and evaluation of its effectiveness.

Methods: To address this issue, we propose a novel approach that combines newly developed symptom provocation techniques with implicit neural, behavioural, and bodily responses to objectively quantify OCD-related symptomatology. In particular, we assess the neural saliency of symptom-provoking versus neutral visual stimuli via frequency-tagging electroencephalography (FT-EEG) and low-frequency oscillation power; attentional orienting and avoidance via eye tracking; and stress physiology via heart rate and skin conductance.

Results: We will present preliminary FT-EEG findings of adults with OCD compared to the responses of healthy controls. Additionally, we will outline the design of a future study where we will monitor symptom severity throughout cognitive behavioural therapy (CBT) and deep brain stimulation (DBS).

Conclusion: Our findings may offer novel insight in the neurobiological mechanisms and aberrant emotional processing underlying OCD, and can constitute a crucial step towards developing a biomarker of OCD severity.

Thursday, May 23rd 2024 // 10:30am - 12:00pm

*Location: Auditorium 1
Symposium 3*

Interoception: From fundamental research to clinical applications

Diego Candia-Rivera, Mateo Leganes-Fonteneau, Pauline Billaux, Olivier Desmedt

Interoception is crucial in shaping cognitive, emotional, and physiological processes. A deeper understanding of basic mechanisms could thus inform clinical interventions. Here we present a range of multidisciplinary research on how the brain and the body act in coordination to generate subjective experiences. Based on neuroimaging studies and computational psychophysiology, we then propose a basis for how a dysregulated integration of bodily signals in the brain can underlie addiction, anxiety, and depression. We also present novel tools to study subjective bodily experiences in clinical and non-clinical populations, and propose novel interventions targeting interoceptive processes.

Talk 1 - Diego Candia-Rivera

Interoceptive mechanisms at the edge of consciousness

Research on the physiology of interoceptive mechanisms has proven valuable in various clinical cases, specifically in those linking cardiovascular, neurological, and psychiatric disorders with changes in brain-heart interactions. Our experimental evidence on patients with disorders of consciousness revealed that observing brain-heart interactions helps to detect residual consciousness, even in patients with absence of behavioral signs of consciousness. Those findings support hypotheses suggesting that visceral activity is involved in the neurobiology of consciousness and sum to the existing evidence in healthy participants in which the neural responses to heartbeats reveal perceptual and self-consciousness. Furthermore, the complex and bidirectional communication between brain and heartbeat dynamics can provide insights into the physiological state of the patient following severe brain injury. We recently revealed that these interactions give insights into patients' outcomes and their transient cognitive disturbances, such as the case of delirium. The developments on methodologies to analyze brain-heart interactions open new avenues for understanding neural functioning at a large-scale level, uncovering that bodily activity can influence brain homeostatic processes, cognition, and behavior.

Talk 2 - Olivier Desmedt

Interoceptive Phenomenology: The Introduction of a New Toolbox

Interoception, the processing of internal bodily states, is increasingly recognized as pivotal in mental health. It shapes our subjective experiences and decision-making processes, with interoceptive abilities modulating our internal bodily sensations. Despite their significance, the operationalization of these hypotheses has faced

important challenges. Traditional studies have primarily focused on detection abilities, yet a comprehensive and valid measure of this construct remains elusive. Moreover, other dimensions of interoception, such as interoceptive attention and interpretation, demand further exploration. Critically, the direct impact of internal bodily sensations, or interoceptive phenomenology, has been largely overlooked. This presentation advocates for a rigorous, systematic exploration of interoceptive phenomenology across various contexts and populations. To this end, bodily mapping emerges as a promising methodology. We introduce 'InteroMap', a new open-access bodily mapping tool that captures the two fundamental phenomenological attributes of bodily sensations: their valence and intensity. Our presentation highlights a validation study of InteroMap, focusing on user experience, validity, and reliability. We replicate the groundbreaking experiment by Nummenmaa et al. (2014), which identified distinct bodily patterns for basic emotions, using both their tool (emBODY) and InteroMap. This approach allows the validation of our tool but also the evaluation of its added value over existing methods. In conclusion, InteroMap opens a myriad of research possibilities, offering a standardized and systematic method for investigating the role of interoceptive phenomenology in diverse phenomena, including emotions, cravings, addictive behaviors, and beyond.

Talk 3 - Pauline Billaux

Understanding interoceptive processes in substance use disorder: a combined neuroimaging and behavioral approach

Recent theoretical models have suggested that interoception is key to addictive disorders, as interoceptive information contributes to craving (i.e., the irrepressible urge to consume the substance). However, experimental data are lacking at cerebral and cognitive levels to confirm this assumption. We thus initiated the exploration of interoceptive processes in substance use disorders (SUD) through two experimental studies. First, as insula is an interoceptive hub, we used MRI to explore the integrity of six bilateral insular subregions among 50 patients with severe alcohol (sAUD) and 61 with cocaine use disorder (sCUD). We found a reduced gray matter volume of the posterior insula (involved in the early processing of interoceptive signal) in both SUD, combined with an atrophy of the left anterior part in sCUD only. Second, we explored the behavioral ability to detect and interpret interoceptive information in SUD. To do so, we used body mapping to measure how individuals with clinical (97 sAUD patients) or sub-clinical (91 student binge drinkers) AUD identify the body signals related to craving. We showed that sAUD patients can report body signals related to craving (particularly tremors, perspiration and palpitations in the forehead, shoulder/thorax and hands), but that these craving-related body feelings are far less diverse and elaborated, as well as a far more negative/painful than those reported by binge drinkers. The current results thus bring initial insights regarding the cerebral and behavioral correlates of interoceptive processes in SUD, paving the way for a systematic neuropsychological evaluation of interoception in these populations.

Talk 4 - Ryan Smith

Breath-Holding Modulates Computational Mechanisms of Interoception in Healthy but Not Transdiagnostic Patient Samples

Recent computational theories of interoception suggest that perception of bodily states rests upon a precision-weighted integration of afferent signals and prior beliefs, and that aberrant precision-weighting may lead to misestimation of bodily states and promotion of psychopathology. In a previous study, we fit a Bayesian computational model of perception to behavior on a heartbeat tapping task to test this idea. We found that, during an interoceptive perturbation designed to amplify afferent signal precision (inspiratory breath-holding), healthy individuals increased the precision-weighting assigned to ascending cardiac signals relative to resting conditions, while individuals with symptoms of anxiety, depression, substance use disorders, and/or eating disorders did not. Here, we conducted a pre-registered study in which we aimed to replicate our prior results in a new transdiagnostic patient sample (N=285) including anxious and depressed individuals similar to the original study. Results successfully replicated those found in our previous study: we again observed a failure to update interoceptive precision-weighting during the breath-hold across all patient groups relative to healthy participants (linear mixed effects model: $t(806) = -2.56$, $p = .011$). Follow-up analyses combining samples from the previous and current study (N=719) also afforded power to differentiate narrower diagnostic groups within logistic regressions, including those with vs. without depression or specific anxiety disorders in the transdiagnostic sample. Most specific disorders could be differentiated from healthy participants (Wald $z = -3.78$ to -2.16 , $p < .001$ to $.03$), but not from one another.

Talk 5 - Mateo Leganes-Fonteneau

Heart rate variability indexes afferent likelihood spread in interoceptive inference? Examining the effects of resonance breathing on interoceptive awareness

Interoceptive inference perspectives postulate that the brain engages in the continuous monitoring of afferent bodily signals to establish accurate models about the internal state of the body. However, evidence towards these perspectives remains elusive, partially due to the fact that bodily signals are difficult to modulate in a predictable way. Here I present experimental evidence that cardiovascular dynamics, as indexed through measures of heart rate variability (HRV), can be modulated to impact interoceptive awareness.

In a registered report we found that HRV at rest negatively correlated with participants' capacity to detect their own heartbeats. Importantly, participants also completed a slow paced breathing manipulation (6 breaths/minute, 0.1Hz). This manipulation amplifies the resonant properties of the cardiovascular system, generating large oscillations in HRV, specifically at 0.1Hz. We found a positive correlation between oscillatory power at 0.1Hz and increases in interoceptive awareness. The implication is that a less variable, more predictable pattern of cardiac oscillations facilitates the integration of interoceptive signals in the brain. During resonance breathing, this effect is further accentuated, given that cardiac signals are reorganized within a predictive oscillatory pattern at 0.1Hz.

Within a predictive coding framework, HRV could be considered as a proxy for the spread of likelihood of interoceptive signals. Higher HRV would equate to noisier afferent signals, whereas resonance breathing would render afferent signals highly predictable, reducing interoceptive prediction errors. This can bring forth novel mechanistic perspectives for the utility of paced breathing as an adjunct clinical tool, particularly in disorders associated with deficits in interoception.

Thursday, May 23rd 2024 // 10:30am - 12:00pm

Location: Leslokaal 1.2
Symposium 4

Loneliness and mental health: neurocognitive mechanisms and interventions

Lukasz Okruszek, Dirk Scheele

Social isolation and loneliness are established risk factors for mental and physical health. In this symposium, we aim to provide novel insights how social isolation and loneliness may affect neurocognitive processes to confer vulnerability for stress-related disorders and how these findings may be translated to develop targeted interventions. The presented research will illustrate neurocognitive mechanisms of social isolation and loneliness through behavioral, psychophysiological, and hormonal assessments and ultra-high field neuroimaging in samples of healthy adolescents, adults and patients with psychosis. Results of a neurobiologically informed intervention against loneliness will be discussed.

Talk 1 - Livia Tomova

Loneliness and social isolation in adolescents

Loneliness and isolation are increasing in societies all around the world, particularly in young people (Hammond 2019, Twenge 2019). Animal research has consistently shown that a lack of social interaction leads to increased reward sensitivity, higher anxiety and inflexibility during learning – particularly during adolescence (Tomova et al. 2019, Orben et al. 2020). Yet, it is unclear how well results from animal models of isolation can be translated to humans. Do social isolation and loneliness in human adolescents cause similar modulations in brain function and cognition? Previous research in adult humans has shown that acute loneliness affects brain functioning in a similar level as food craving after fasting (Tomova et al. 2020). Using experimental short-term isolation of adolescents aged 16-19 years, we find increased reward processing (including reward responsiveness and reward learning) and fear learning following isolation. We also assessed whether access to virtual social interactions mitigates the effects of isolation and find that access to virtual social interactions remediates some, but not all effects of isolation. Using structural equation modelling of ABCD data we then analysed whether and how results from the laboratory translate to real-life effects of loneliness. The implications of this research in the light of adolescent loneliness and mental health problems will be discussed.

Talk 2 - Lukasz Okruszek

Loneliness and Socio-Affective Processing: Behavioral and Neural Mechanisms

It has been emphasized that one's perception of a mismatch between actual and desired social relationships may have deleterious effects on mental and physical

health. Due to the evolutionary significance of social connections, loneliness is believed to activate processes aimed at reconnecting with others, including the preferential processing of social signals. However, due to the self-preservation bias, these processes may sensitize one's cognitive system to potential social threats. In line with this conceptualization, lonely individuals may exhibit abnormal bottom-up responses when processing socio-affective stimuli. Furthermore, such mechanisms may also deplete cognitive resources, preventing the application of top-down mechanisms (e.g., cognitive reappraisal techniques; CR) that could counter biased information processing.

The presented study aimed to investigate behavioral and physiological markers observed during the processing of social and nonsocial affective content across the loneliness spectrum. A total of 150 participants were presented with static pictures from affective picture databases containing either neutral or negative social or nonsocial content. They were instructed to either passively observe or reappraise the presented pictures while their EEG and behavioral ratings were recorded. In line with our expectations, we observed the effects of both affective content (negative > neutral) and emotion regulation use (reappraise < watch) on behavioral and physiological markers of stimuli processing. However, no expected association between loneliness and bottom-up and top-down mechanisms was found. The findings of the study suggest that trajectories linking loneliness to specific cognitive processes may be more nuanced and complex than initially hypothesized.

Talk 3 - Anne-Kathrin Fett

Loneliness and social isolation in psychosis

Individuals with psychotic disorders often experience chronic social isolation and high loneliness. Yet, the role of these in the development of paranoid thinking has been largely unexplored. Seventy-five participants, including 29 individuals with a diagnosis of non-affective psychosis, 20 first-degree relatives, and 26 controls used an Experience Sampling Method (ESM) app to capture the fluctuations in loneliness, feelings of social exclusion, isolation and paranoia, across a 1-week period. A subsample completed a multi-round trust game during functional Magnetic Resonance Imaging. All groups experienced significantly greater paranoia in company of strangers/distant others than familiar others and being with familiar others was associated with significantly lower paranoia over time. Patients experienced most paranoid thinking when alone. In all groups, loneliness and feelings of social exclusion were independent significant predictors of paranoia over time. Paranoia predicted social exclusion over time, with more pronounced effects in controls than patients. Paranoia did not predict feelings loneliness. In patients, lower trust was associated with more time spent alone and social exclusion and lower caudate activation was associated with higher perceived social exclusion. Paranoid thinking worsened in all groups when being with strangers, rather than familiar others and following feelings of loneliness and social exclusion. Neuroimaging findings suggest a role of social reward processing. This highlights the importance of social connections, a sense of belonging and being included for mental well-being. Loneliness and feeling socially excluded were independent predictors of paranoid thinking, suggesting they represent useful targets in its treatment.

Talk 4 - Jana Lieberz

Oxytocin-augmented modular-based group intervention for loneliness

Loneliness poses a significant health problem and existing psychological interventions have shown only limited positive effects on loneliness. Based on preliminary evidence for impaired oxytocin signaling in trait-like loneliness, the current proof-of-concept study used a randomized, double-blind, placebo-controlled design to probe intranasal oxytocin (OT) as an adjunct to a short-term modular-based group intervention for individuals suffering from high trait-like loneliness (HL, UCLA loneliness scale ≥ 55). Seventy-eight healthy HL adults (56 women) received five weekly group psychotherapy sessions targeting cognitive biases in loneliness. HL participants received OT or placebo before the intervention sessions. Primary outcomes were trait-like loneliness measured at baseline, after the intervention, and again at two follow-up time points (three weeks and three months), and, assessed at each session, state loneliness (visual analog scale), perceived stress (Perceived Stress Scale, PSS-10), quality of life (World Health Organization Five Well-Being Index, WHO-5), and the therapeutic relationship (Group Questionnaire, GQ-D). The psychological intervention was associated with significantly reduced perceived stress and improved trait-like loneliness across treatment groups, which was still evident at the 3-month follow-up. OT had no significant effect on trait-like loneliness, quality of life, or perceived stress. However, compared to placebo, OT significantly facilitated the decrease in state loneliness within sessions and significantly improved positive bonding between the group members. Despite significantly improved trait-like loneliness after the intervention, OT did not significantly augment this effect. Further studies are needed to determine optimal intervention designs to translate the observed acute effects of OT into long-term benefits.

Location: Leslokaal 1.3
Symposium 5

The power of social influence on decision-making, and what it takes to say 'No'

Emilie Caspar, Nicolas Coucke, Guillaume Pech, Leslie Tricoche

Social influence, whether it is following a leader's directive or conforming to groups, is known to significantly impact decision-making, as individuals are often influenced by the opinions, actions, and behaviors of others. The symposium focuses on how obedience to authority and group conformity shape individual choices and behaviors in moral and non-moral contexts. Using neuroscience techniques such as MRI, EEG, and hyperscanning, we examine the factors driving resistance to these social influences. Our research includes diverse populations from three continents, both civilian and military, and integrates interviews with genocide perpetrators to provide a comprehensive understanding of social influence on behavior.

Talk 1 - Emilie Caspar

The neuroscience of obedience to immoral orders and conformity

It is no longer necessary to establish that human beings can follow orders, even those that are cold-blooded. As Howard Zinn has pointed out, 'historically, the most terrible things - war, genocide, and slavery - have resulted not from disobedience, but from obedience' (Zinn, 1997). Beyond historical events, experimental research has highlighted the human tendency to obey orders that could cause serious harm to others (Milgram, 1963). Decades after Stanley Milgram's seminal studies, a neuroscientific perspective on obedience has emerged, aiming to understand how obeying orders can lead to moral transgressions and antisocial behavior. Recently, neuroscience has also started to engage in uncovering the neural mechanisms at play when people act jointly to perform an action and conform to a group. This presentation will present recent findings using electrophysiological and neuroimaging techniques across various populations (e.g., civilians, military, inmates), demonstrating how obedience and conformity to a group alters neuro-cognitive processes in moral decision-making. Addressing conformity and obedience to immoral orders necessitates also obtaining a broader understanding of mass atrocities. Additionally, the presentation will include qualitative interviews with former genocidaires from Rwanda and Cambodia, attempting to draw parallels between qualitative data and neuroscience research findings. Transcending the boundaries of different scientific disciplines is key to better understanding how obedience and conformity alters prosociality and in this presentation, I will defend the provocative idea that researchers should seize the opportunity to leave their laboratories to study the issue of obedience.

Talk 2 - Nicolas Coucke

Empathy vs. obedience: inter-brain synchrony in military and civilians

Hyperscanning is a highly timely technique in cognitive neuroscience that involves recording the brain activity of multiple subjects simultaneously. There has been an increase in research using EEG-based hyperscanning for social interactions, as it facilitates truly social (or 'second person') approaches, where neural processes are examined in the context of real-time reciprocal social interaction. The present study demonstrates how EEG-hyperscanning methods can be used to understand the interactions and synchrony of individuals in a hierarchical chain. Military and civilian participants were assigned roles: commanders, executioners, and a victim. Initially, executioners could bond with the commander and victim during a drawing task, with their brain activity recorded via hyperscanning. Subsequently, in a moral decision-making task, commanders ordered the executioner to send or withhold a painful shock to the victim for €0.05 per trial. The executioner had the choice to obey or disobey the orders received. Brain activity was also measured in a hyperscanning set-up to investigate how synchrony between the executioner, commander, and victim predicts obedience or disobedience to the commander's orders. Results indicated greater neural synchrony with individuals with whom a strong connection was built during the drawing task. Furthermore, resisting a commander's instruction was more cognitively demanding than complying. These findings are discussed in terms of the relevance of hyperscanning methods in studying how brain synchrony between individuals influences their moral behavior.

Talk 3 - Guillaume Pech

Obedience Vs Conformity: A cross-cultural EEG study in Rwanda, Cambodia and Belgium

Conformity and obedience are distinct yet interconnected phenomena illustrating the power of social influence on individual behaviors (Cialdini & Goldstein, 2004). The extent to which these social influences affect behaviors and their neural mechanisms is largely unknown. In our study, participants had to choose whether to follow the opinion of an authority figure, a group, or an individual in relation to prosocial behavior. This experiment was conducted in three culturally distinct countries: Belgium, Cambodia, and Rwanda. We measured the conflict in decision-making using reaction times (RT) and mid-frontal theta activity. Results indicated that in all countries, group opinions influenced participants' decisions more than those of an individual. In Belgium, groups had a greater impact than authority figures. Participants were faster to choose authority over groups and individuals in all countries, suggesting less conflict when selecting authority. Authority was the easiest choice across nations. In conclusion, authority had a more substantial impact in Cambodia than in Belgium and Rwanda, with Belgium showing a stronger influence of authority over individuals compared to Rwanda. These results suggest that while there are commonalities, cultural differences may influence susceptibility to various social influences.

Talk 4 - Leslie Tricoche

Resisting to immoral orders, a comparison between civilian and military populations

People's ability to resist immoral orders is a fundamental aspect of individual autonomy and of democratic societies. Milgram's studies mostly described psychological and contextual components which make an individual to obey or disobey immoral orders, but the neuro-cognitive processes that prevent an individual from being coerced into causing pain to others have almost not been investigated. By using a new protocol targeting disobedience, in a fMRI study we explored the neural signature of disobedience to immoral orders in 57 young adults. Based on previous studies, we particularly focused on two key neuro-cognitive processes: sense of agency (SoA) and empathy for pain. In an exploratory fashion, we also targeted the feeling of guilt and cognitive conflict. Our results indicated that most individuals were able to refuse to send a shock, as more than 70% of them disobeyed in at least 10% of the trials where experimenter ordered to send a shock to a victim. When comparing obedience to send a shock with prosocial disobedience at brain level – on Cognitive conflict, SoA, Empathy and Guilt epochs – we found a temporally-increased involvement of regions associated to the social brain among with Angular Gyrus, Temporo-Parietal Junction, Supramarginal Gyrus, or Precentral areas. By conducting correlation analyses, we revealed that, in addition to this network, also median prefrontal regions were negatively associated with prosocial disobedience. Together, these results suggested that individuals need to mentally disengage from the experimenter's order to switch from obedience to disobedience.

Location: Leslokaal 3.2
Symposium 6

Novel approaches to study self-other distinction in different domains and in both typically developed and clinical populations

Ekaterina Pronizius, Ulrike Kraemer, Rebecca Boehme, Henryk Bukowski

To navigate interpersonal interactions, we need to develop and maintain a clear boundary between “self” and “other”. This ability to distinguish between self and other is referred to as self-other distinction (SOD), which encompasses perceptual, cognitive and affective domains. Dysfunctional SOD might contribute to psychiatric disorders, which is why it is important to develop reliable and valid methods to characterize interindividual differences in SOD. In this symposium, we will present novel methods to study SOD across different domains and discuss findings on the behavioral and neural processes associated with (dys)functional SOD.

Talk 1 - Ekaterina Pronizius

Self-Other Distinction Self-reported Questionnaire (SOD-SQ): A scale to measure self-other distinction in the everyday life of healthy and clinical populations

To smoothly navigate the social world, we benefit from a permeable barrier between the “self” and the “other”: Information about other people is efficiently processed and often spontaneously comes to our mind whereas information about oneself can be efficiently accessed to guess other people’s mental states. However, this information about others (e.g., their opinions or emotions) can also intrude or invade our minds whereas our own opinions or emotions may bias and mislead our understanding of other people. Being able to distinguish and maintain a clear barrier between the self and the other is an essential mechanism to navigate the social world, called self-other distinction (also referred to as self-other control). Individual differences in self-other distinction (SOD) capacities are clinically observed and empirically evidenced via experimental paradigms that induce egocentric and altercentric biases. Aiming to have a more practical and ecological measure of SOD, we developed a self-report questionnaire that captures everyday life manifestations of SOD ranging from well-functioning SOD to clinically dysfunctional SOD. To separately measure distinct components of SOD, the questionnaire has 4 quadrants crossing the direction of the intrusion (self-to-other versus other-to-self) and the domain of intrusion (emotional versus cognitive domain), plus an additional subscale to capture self-other awareness. The scale went through multiple rounds of empirical validation that helped inform and clarify the definition and structure of SOD. In this talk, we will present the Self-Other Distinction Scale, how we constructed SOD, and the empirical evidence of validity.

Talk 2 - Ulrike Kraemer

Behavioral and neural correlates of emotional self-other distinction – presenting a novel, food-based emotional egocentricity bias task (FEEB)

Self-other distinction is a central component of empathy, allowing us to distinguish simultaneous mental representations of our own and other's emotional experience. Deficits or limitations of this capacity become apparent, when our own emotional state biases our perception of other's emotions (termed emotional egocentricity bias, EEB), or, vice versa, when others' emotions influence our perception of our own emotional state (emotional altercentric bias, EAB). We developed a novel paradigm to study emotional self-other distinction based on emotional responses to food stimuli. In several behavioral studies, we found evidence for both an EEB and EAB, and could show that the EEB shows satisfying retest-reliability in this paradigm. Using fMRI, we found that conditions in which emotional responses of self and other were incongruent, requiring a distinction between self and other, elicited activity in the right supramarginal gyrus. This replicates previous work on emotional self-other distinction using tactile stimuli. However, in contrast to previous studies, the strongest response was found in the anterior insula and in the cerebellum. This suggests that emotional self-other distinction relies on at least partly modality specific brain networks. We will present the behavioral, fMRI and EEG data using this paradigm, and discuss how the paradigm can be used to study situational and interindividual influences on emotional self-other distinction.

Talk 3 - Rebecca Boehme

Self-touch and social touch as avenues to study aspects of bodily and higher order self

The earliest and clearest perception of the self's physical boundaries is experienced through touch, making it a fundamental sensory modality for the differentiation between self and other. Throughout the lifespan, social touch emerges as a cornerstone for the development of both the individual's bodily awareness and their capacity to navigate interpersonal interactions. The talk incorporates findings from studies investigating the neural and behavioral processes associated with tactile self-other-distinction, encompassing both neurotypical and neurodiverse populations. Utilizing functional brain imaging, our research employs self-touch and affective touch from external sources to contribute to an understanding of the mechanisms underlying the differentiation between self and other. Additionally, we examine how disruptions in these processes may contribute to an altered sense of self, shedding light on potential implications for mental health.



May 23rd – 12:00pm – 2:00pm

POSTER SESSION 1

Location: Cafeteria
Poster 1

The Influence of Schizotypal Traits on Spatial and Emotional Perspective Taking

Alexandra de Lagarde, Louise Kirsch, Mariana von Mohr, Malika Auvray

The ability to adopt someone else's perspective is at the core of social cognition. Perspective-taking encompasses a variety of cognitive processes involving the ability to infer others' emotions or feelings (affective perspective-taking) and the ability to understand their visuo-spatial perception (spatial perspective-taking). Yet, the intricate relationship between perspective-taking dimensions remains to be unveiled. In particular, whether perspective-taking is a global or domain-specific mechanism would help understanding whether certain populations with deficits in one dimension (e.g., emotional perspective-taking) also face difficulties in another (e.g. spatial perspective-taking). In this online study conducted on 135 neurotypical participants, the Visual Graphesthesia Task and the Emotional Egocentricity Bias Task were used to investigate potential links between these dimensions. Schizotypal, empathic, and autistic traits were also measured through self-report questionnaires, as certain psychiatric conditions are known to affect either one or the other dimension of perspective-taking. Exploring participants' trait profiles through interquartiles revealed significantly different biases in the spatial and in the emotional task, when comparing participants with the lowest and the highest schizotypal scores. Regression models confirmed these results, as schizotypal traits were found to be significantly predicted by the interaction existing between spatial and emotional egocentric biases. Therefore, the link between these two dimensions of perspective-taking may vary depending on psychiatric conditions, such as schizotypy. This opens the way to much needed systematic studies on the links between the numerous processes involved in perspective-taking in clinical populations characterized by deficits in perspective-taking.

Location: Cafeteria

Poster 2

Internet-delivered Cognitive Behavioral Therapy for Premenstrual Dysphoric Disorder: Study protocol for a randomised controlled trial

Johanna Motilla Hoppe, Maria Kleinstaeuber, Gerhard Andersson, Alkistis Skalkidou, Johan Vigelius, Erika Comasco, Elisavet Kalsouni, Monica Buhrman, Cornelia Weise

Introduction. Premenstrual dysphoric disorder (PMDD) is a highly debilitating cyclic mental disorder affecting about 5% of women of reproductive age. PMDD is characterised by premenstrual symptoms such as mood swings, irritability, and depressed mood, which often lead to emotion dysregulation. Although pharmacological interventions are available, many women experience residual symptoms, discontinue treatment, or refrain from them due to side effects. Therefore, accessible non-pharmacological interventions are needed as an alternative or complement. Preliminary findings suggest that Internet-delivered cognitive behavioural therapy (iCBT) may be a promising avenue. However, further research is warranted to establish its effects and dismantle its active components. This upcoming study will evaluate the efficacy of iCBT for PMDD in a randomised controlled study and examine the relationship between emotion dysregulation and treatment effects.

Methods. One hundred sixty women (age 18-45) fulfilling the DSM-5 diagnostic criteria for PMDD will be randomly assigned to eight weeks of guided self-help iCBT or waiting list. The treatment includes psychoeducation, emotion regulation strategies, cognitive techniques, and health-promoting behaviours. Linear mixed models will be used to evaluate treatment effects on outcome measures, including self-reported PMDD symptoms, psychological and functional impairment, quality of life and emotion dysregulation. Long-term treatment effects will be assessed 6 and 12 months post-treatment. The relationship between emotion dysregulation and symptom reduction will be examined using Gaussian process modelling. Recruitment is planned for August 2024.

Main conclusions. The study will elucidate the potential utility of iCBT as a treatment for PMDD and the relationship between emotion dysregulation and treatment effects.

Location: Cafeteria
Poster 3

Emotion anticipation and processing in depression: linking behavioral, neural and physiological reactivity

Magdalena Wlad

Depression is characterized by disturbed emotion processing, with aberrant neural and physiological responses to emotional stimuli. Here, we applied an emotion anticipation and processing paradigm to investigate neural reactivity in the brain and electrodermal reactivity in patients with depression compared with healthy controls. The study included 42 patients and 44 healthy controls. Subjects underwent functional magnetic resonance imaging with simultaneous measuring of electrodermal activity. During scanning, red or green color cues were presented, followed by picture stimuli of negative or positive valence, respectively. Behavioral valence and arousal ratings of the picture stimuli were conducted outside of the scanner. Anhedonia was assessed through a semi-structured interview in both subject groups. Our results showed differences in emotion anticipation and processing at the neural, physiological and behavioral level in depressed patients compared with healthy controls. Patients perceived positive pictures as less positive than controls did ($p < 0.001$). Clinical assessments showed increased anticipatory and consummatory anhedonia in the patient group ($p < 0.001$). Positive anticipation (i.e., green color cues) elicited stronger activations in the bilateral anterior cingulate cortex (ACC) ($p = 0.006$) and the right insula ($p = 0.014$) in patients than in healthy controls, indicating salience network disturbances. Positive and negative anticipation elicited stronger electrodermal responses in controls ($p = 0.011$, and $p = 0.012$, respectively), which is in line with previous reports of sympathetic hyporeactivity in depression. However, electrodermal reactivity to negative pictures was higher in patients than controls ($p = 0.016$).

In summary, our findings highlight that an ongoing depression affects emotion anticipation and processing at the behavioral, neural and physiological level.

Location: Cafeteria

Poster 4

Effect of prior recognition of social information on emotional attribution bias - Relationship with autism spectrum and social anxiety tendency-

Yuka Hirayama

Autism Spectrum Disorder (hereinafter "ASD") and Social Anxiety Disorder (hereinafter "SAD") often coexist, presenting overlapping symptoms that complicate clinical diagnosis. This study explores the cognitive processing mechanisms of anxiety in individuals with varying ASD tendencies, focusing on the specificity of emotion attribution biases. Prior research suggests differences in how individuals with and without ASD experience anxiety, especially about social anxiety tendencies and brain structure correlations.

We investigated how prior negative social information about others affects emotion attribution in individuals, and how ASD and SAD tendencies moderate the effect using behavioral experiments (e.g. emotion label task and emotion match task).

We found that individuals with higher SAD tendencies exhibited detection of emotion on face recognition of others becoming slow when they recognized negative information of others in advance, while those with lower SAD tendencies showed detection of emotion on face recognition of others becoming faster when they recognized the negative information of others. There was no such effect on ASD tendencies. The results indicate that there are different biases on ASD and SAD tendencies when inferring other's emotions.

This investigation is crucial for developing targeted interventions and improving diagnostic accuracy in co-occurring ASD and SAD. Future research should focus on refining experimental procedures and use a larger sample size to further understand emotion attribution biases in ASD and SAD and their impact on daily social anxiety.

Location: Cafeteria

Poster 5

Hierarchical modeling of the relationships between psychiatric symptoms and attitudes to risk and ambiguity

Johan Vegelius, Andreas Frick

Psychiatric symptoms are associated with reduced risk-taking and changes in ambiguity attitudes in gambling tasks, although findings are mixed. Relationships between such latent constructs are often investigated by first estimating the corresponding scores for each participant and then perform multivariate regression (MVR) using these scores. The errors in the first step estimations introduce potential bias and reduce power. Hierarchical models (HM) alleviate this risk, and although HMs for specific cases are readily available (e.g. linear mixed models and structural equation models), no standard implementations of HM for combining arbitrary data types exist.

We developed a hierarchical modeling framework allowing arbitrary data types using a variational inference approach and tested it on simulated and real data from 98 adults performing a risky and ambiguous gambling task and the Inventory of Depression and Anxiety Symptoms (IDAS-II). The HM consisted of a joint distribution between a simultaneous confirmatory factor analysis of IDAS-II (17 symptom dimensions and 3 factors) and a computational model of attitudes to risk and ambiguity based on the gambling task.

The HM yielded significant relations between risk attitude and Distress, and ambiguity attitude and OCD and Positive mood, but MVR failed to detect any such relations ($p > 0.1$). Simulations ($N=100$) showed less bias and RMSE for HM.

The proposed HM outperformed standard two-step procedures on real and simulated data and provides a flexible framework for analyzing arbitrary data types. Because the joint distribution is approximated by a multivariate normal distribution, the marginal likelihood has closed form solution, allowing fast optimization.

Location: Cafeteria

Poster 6

Cognitive Control Training for Depression Relapse Prevention with Wearable Activity and Sleep Monitoring: a single-case experimental study

David Demeester

Cognitive control training (CCT) holds promise as an intervention for preventing depression recurrence. Prior research and meta-analytic evidence demonstrated that this neurocognitive intervention can effectively reduce the likelihood of future depressive episodes and improve cognitive abilities. However, previous studies have not yet focused on the temporal unfolding of CCT effects. To address this, we are conducting a single-case experimental study that employs an experience sampling methodology with a multiple baseline across participants design to investigate the effectiveness of the adaptive Paced Auditory Serial Additive Task (aPASAT), an online cognitive computer task commonly utilized in cognitive control training. This study specifically focuses on individuals exhibiting subclinical depressive symptoms, particularly those who also experience cognitive complaints associated with depression. In addition to the daily completion of a smartphone-based questionnaire that assesses depressive symptomatology, repetitive negative thinking, and stressors, objective measures of depression are obtained using a wearable device. This approach enables the collection of data on various parameters, including activity levels and sleep patterns over time. By combining objective and self-report measures, the study gains a more comprehensive understanding of the participants' depressive symptomatology and the temporal unfolding effects of cognitive control training. This study will still be ongoing at the time of the presentation; however, we will be presenting preliminary results.

Location: Cafeteria

Poster 7

Exploring Vocal Smile Integration In Autism: From Acoustic Representation To Facial Motor Resonance

Annabelle Merchie, Zoé Ranty, Claire Wardak, Emmanuelle Houy-Durand, Jean-Julien Aucouturier, Marie Gomot

Both recognition and production of emotions rely on mental representations of underlying physical characteristics of each expression. However, little is known about how autistic people internally represent vocal expressions of emotions and whether this representation might impact emotional resonance. Atypical response to smile, together with unusual prosody, are early hallmarks of autism.

Objectives of the current study were to evaluate model of vocal smile with a reverse correlation paradigm and facial motor resonance to smiling and unsmiling sounds using EMG in a group of autistic (n=12) and neurotypical adults (n=25).

Autistic adults used the same acoustic indices than neurotypical to characterized vocal smile. Moreover, when this model was applied to sentences, autistic adults were as good as neurotypical in emotional prosody recognition. In neurotypical adults, a dissociation between implicit and explicit motor resonance was observed with the Zygomaticus major reflecting perception of emotional prosodic content with larger activity for smiling sentences, while the Corrugator supercilii activity was sensitive to judgement. Conversely in autistic adults, facial muscles activity did not vary according to perception nor judgement of emotional prosody.

Thanks to an integrative approach, it was possible to disentangle atypical motor resonance from atypical mental representation of vocal smile in Autism. Behavioral difficulties observed in autism appear to be a consequence of reduced motor resonance rather than alterations in mental representation. Even in a small sample, effects seem quite robust but should be confirmed in a larger sample to be collected as part of the final study.

Location: Cafeteria
Poster 8

Effect of the presence of neurodivergent traits on the risk and age of onset of dementia

Gabriela Stanislavova

Background:

There is conflicting evidence about whether the presence of neurodivergent traits, such as autism spectrum disorder (ASD) and attention deficit hyperactivity disorder (ADHD) increases a person's risk of developing dementia. The aetiology of neurodivergence and dementia is multifactorial, and common environmental and biological factors may shed light on a potential link between the two. The current study explores possible connections between the presence of neurodivergent traits and dementia age of onset. This study is being undertaken by a medical student as a part of an independent research project and the results will be collected and analysed by March 18th 2024.

Methodology:

In this case-control study adults aged >50 years with and without a formal, physician-based diagnosis of dementia were recruited. Participants were asked to complete an online survey including demographic details, the Cognitive Difficulties Scale (CDS), The Ritvo Autism and Asperger's Diagnostic Scale (RAADS-14) and the Adult ADHD Self-report Screening Scale (ASRS-5). Participants' scores will be used to assess associations between age of onset of dementia, the degree of cognitive impairment, and likely presence of ADHD and ASD. Sub-analysis will be conducted assessing confounders' effect on the link between neurodivergence and dementia.

Hypothesis:

Higher RAADS-14, ASRS-5 and CDS scores will be associated with a higher risk of developing dementia at an earlier age.

Outlook:

This study will contribute to a body of research about the relationship between neurodivergent traits and onset of dementia. Determining the link between the two can be beneficial for early detection, diagnosis and improved care.

Location: Cafeteria
Poster 9

Social decision-making in severe alcohol use disorder: exploration through the “Prisoner’s dilemma” paradigm.

Mado Gautier

Introduction: Cerebral and cognitive deficits have long been identified in severe alcohol use disorder (sAUD), but the exploration of social cognition is relatively new. A large amount of studies has documented that patients with sAUD present widespread difficulties to identify and interpret emotional and interpersonal signals from others. However, social decision-making, namely the way patients with sAUD actually behave during social interactions, beyond their impaired ability to passively detect social cues, remain unexplored. Social decision-making research in healthy and pathological populations has largely capitalized on the game theory and its related economic games, as they allow the direct measurement of social behavior when the participant is actively involved. We thus explored social decision-making abilities among patients with sAUD using the prisoner’s dilemma, an economic game evaluating cooperation / competition tendencies. Method: We tested 40 recently detoxified patients with SAUD and 40 healthy controls on six computerized iterated Prisoner’s dilemma games, namely 2 opponents (fake “human” vs computer, to explore the influence of interacting with another human on the decision process) x 3 strategies (random vs cooperative vs competitive, to explore how participants adapt their social decision strategy to the opponent’s behavior). Results and conclusion: As hypothesized, patients with SAUD are more competitive than healthy controls. Centrally, such social decision-making bias is related to the disease’s course, as we found a link between the intensity of the competitive bias and relapse at six months follow-up. Such bias could potentially favor the transition between social cognition alterations and actual maladaptive social behaviors.

Location: Cafeteria

Poster 10

Non-Verbal Behaviours and Social Perception in Autism

Marta Robles, Daniel Roth, Christine M. Falter-Wagner, Lorena Chanes

Autistic individuals present differences in behaviour and in perception of social interaction when compared to typically developing (TD) individuals. Here, we present two studies that included both autistic and TD adult individuals exploring these domains. In the first study, we explored facial expression predictions and social judgements using a social perception task. Autistic participants exhibited less stereotypical predictions regarding facial expressions, yet their use of these predictions in social evaluation remained intact. In a second study, we investigated the potential of virtual reality technology and machine learning, as an objective tool for distinguishing non-verbal behaviours between autistic and TD adult individuals. Participants engaged in a virtual reality supermarket, interacting with an avatar functioning as the seller, while their eye gaze, hand movements, and head movements were recorded. Findings indicated distinctive gaze patterns among autistic participants, with a shift towards the background and reduced focus on the eye region compared to TD individuals. No differences were found in perceived rapport during the interaction with the avatar. While these studies show that autistic individuals indeed present differences in the non-verbal domain, results also refine our knowledge of social perception processes in autism. This research contributes novel insights into the nuanced nature of non-verbal behaviours and social perception in autism, highlighting both differences and similarities with TD individuals in these domains.

Location: Cafeteria

Poster 11

Empathy enhances decoding of human brain responses to emotional expressions of dogs

Miiamaaria Kujala

Factors that contribute to the classification accuracy of neurophysiological brain responses at the individual level, besides attention, are largely unknown. As empathy affects the subjective experience of socio-emotional stimuli in many ways, we examined the effect of subjects' empathy on the accuracy of machine-learning-based classification of the event-related brain responses to human and dog emotional facial expressions. 15 healthy volunteers, aged 28 ± 4 years (mean $\pm$ SD; 8f/7m) observed photos of human and dog threatening, pleasant and neutral facial expressions (10 different images per category) during a 306-channel magnetoencephalography acquisition, with a duration of 500 ms per stimulus and interval of 500–1500 ms. Support vector machine -based discrimination of event-related brain responses at 0–500 ms was successful between all stimulus categories. The classification accuracy for threatening vs. pleasant/neutral dogs was 72/71%, and for threatening vs. pleasant/neutral humans 69/70 %. The correlation between empathy (emotional concern of Interpersonal Reactivity Index) and the classification accuracy between the threatening vs. pleasant or neutral dog/human faces was further examined with Spearman's rho using a bootstrapping procedure (1000 samples). Subjects' emotional concern correlated with the classification accuracy between threatening vs. pleasant or neutral dogs ($r_s = 0.76$, $p = 0.001$, CI 0.39–0.92; $r_s = 0.56$, $p = 0.031$, CI 0.05–0.84), but not with classification accuracies of threatening vs. pleasant or neutral humans ($p > 0.05$). To conclude, empathy enhances accuracy of decoding brain responses to threatening dog expressions, likely reflecting attentional engagement through involuntary emotional reactivity and subcortical magnocellular pathway.

Location: Cafeteria
Poster 12

Visual-spatial reasoning performance under social observation and collaboration: a tangram-based task

Federico Cassioli, Dorine Di Girolamo, Mélanie De Leener, Nellia Bellaert, Mandy Rossignol

Visual-spatial reasoning (VSR), the ability to grasp meanings of spatial relations among multidimensional objects, plays a role in various cognitive processes. Its examination during interindividual conditions offers insights into the interplay between cognitive abilities and social interactions. This project aimed to validate a tangram-based task to study the impact of social observation and cooperation on performance and perceived difficulty. For this reason, we explored VSR performance under different conditions—alone, observed, and cooperation—with multiple levels of tangram difficulty—easy, medium, and difficult—controlling for self-assessed social anxiety (Liebowitz-Social-Anxiety-Scale, LSAS). A trial was considered failed if it exceeded 300s.

Currently, we acquired data on $n=15$ subjects ($Mage=22.27\pm2.76$, age range 18-25). Data collection is still underway. Based on these preliminary data, we fitted generalized-linear-mixed-models (GLMMs) on the considered factors. Predicting the rate of success in hard puzzles based on the condition variable, we found that the odds of success rate in the cooperation trials were approximately 1.91 ($\beta = 0.647$, $p < 0.001$) times higher compared to the alone conditions, while during social observation, participants had 0.47 times lower odds compared to their alone performances ($\beta = -0.756$, $p < 0.001$). Moreover, a difficult tangram is expected to be associated with an increase of 594.5% in perceived difficulty, compared to an easy puzzle ($\beta = 1.939$, $p < .001$) and with a 16% decrease in the cooperation conditions ($\beta = -0.176$, $p < .001$). LSAS was found to be non-significant as a covariate.

These data bring initial evidence supporting the use of tangrams in experiments involving interpersonal interactions.

Location: Cafeteria
Poster 13

The influence of depersonalization on the sense of agency and time perception

Anna Ciaunica, Julia Ayache, Patrick Haggard, Estelle Nakul, Emmanuelle Bonnet, Malika Auvray

Depersonalization (DP) is a condition characterized by feelings of detachment from the self, and associated with an altered experience of time, a core aspect of the sense of agency (SoA). SoA is characterized by the feeling of controlling one's own actions and it can be measured by the compression of the perception of time (i.e., temporal binding) between a voluntary action and its sensory outcomes (i.e., intentional binding). Despite growing research interests in understanding DP, its association with SoA remains unexplored.

The present study investigated the influence of DP on time perception with implicit and explicit measures of SoA. Participants were pre-screened using the Cambridge Depersonalization Scale (CDS) and a questionnaire measuring altered experiences of body awareness, proximal space and time. Participants (N = 115) were divided into HIGH (CDS score > 50) and LOW (CDS score < 20) DP and completed an intentional binding task measuring implicit and explicit SoA.

The results did not reveal any differences in overall implicit and explicit SoA between the two groups. However, the HIGH DP group displayed more time-sensitive markers of SoA, suggesting an association of DP experiences with altered time perception, especially in the absence of intentional movement, stressing the role of self-initiated motion in DP symptoms. Additional analyses revealed group differences in the subjective experiences of body awareness, proximal space and time. Altogether, these results pave the way for exploring the role of time perception, embodiment and motion in DP.

Location: Cafeteria
Poster 14

Exploring the Nexus of Trust and Physiological Synchrony in Dyadic Cooperation

Fabiola Diana, Julia Folz, Ruud Hortensius, Elio Sjak-Shie, Mariska E. Kret

Our study explored the link between trust and physiological synchrony in dyadic interactions, investigating whether increased synchrony fosters cooperation in ecological settings. In the experiment, 122 participants (61 dyads) played a trust game in face-to-face and face-block conditions. We measured Skin Conductance (SC), Heart Rate (HR), pupil dilation, and facial expressions, considering Trustor and Trustee roles as a between-subject factor. The overarching hypothesis proposed a correlation between face-to-face cooperation and physiological synchrony (WLCC method). Surprisingly, findings revealed no significant condition effect on cooperation ($p=.225$). As expected, HR synchrony positively correlated with cooperation ($p<.001$), while SC synchrony findings were non-significant ($p=.349$). A follow-up analysis of Trustor (Risk Taking) and Trustee (Reciprocity) scores showed a negative predictive relationship between HR synchrony and Reciprocity ($p<.001$). This suggests increased HR synchrony within dyads indicates reduced reciprocity from the Trustee, not extending to Risk-taking ($p=.874$). In this discussion, I'll explore task intensity, Trustor and Trustee roles, and the computations in trust and physiological synchrony. Additionally, I'll present results from the ongoing follow-up analysis and a network analysis of mimicry.

Thursday, May 23rd 2024 // 12:00pm - 2:00pm

Location: Cafeteria

Poster 15

(moved to Friday)

Location: Cafeteria
Poster 16

A Shared Moral Compass: The Role of Interbrain Coupling in Establishing Moral Alignment in Groups

Aial Sobeh, Simone Shamay-Tsoory

Humans tend to align their behaviors and beliefs with other group members. This social alignment is vital for maintaining group cohesion, and it extends from behavioral alignment in motion to alignment in abstract beliefs such as moral conventions. We examine how the brains of multiple individuals interact and coordinate during verbal deliberation on moral views to support the evolvement of moral alignment from divergent moral views. We designed a Functional near-infrared spectroscopy (fNIRS) hyperscanning paradigm in which groups of four individuals were asked to rate a series of moral dilemmas three times: first independently in private, then collectively with group members after deliberation, and then once again in private. We assessed the degree to which deliberation within the group led to increasing alignment of moral views by comparing how aligned the group members were in their final private ratings (post-deliberation) compared to their initial private ratings (pre-deliberation). Behavioral results show that group members, whose initial private moral views were not aligned, tend to align their private views after deliberations by adopting the collective sentiment (i.e., the collective ratings). Additionally, as revealed by neuroimaging results, increased interbrain coupling in the left Inferior Frontal Gyrus, between group members during deliberation, predicted the degree of this increase of alignment post-deliberation. The findings of this study indicate that the human tendency to align extends to moral beliefs, and reveal that regions related to mirroring and semantic sequence processing work across brains in coordination to co-create group-level shared moral views.

Location: Cafeteria
Poster 17

The impact of social categorization on the representation of people

Omar Ahmed, Johannes Schultz

Social categorisation is associated with attitudes towards social groups that include ingroup bias, stereotyping or dehumanisation, which in turn facilitate behaviours like social support, discrimination or aggression. This categorisation influences even early stages of social interactions, such as face perception: ingroup faces evoke different neural responses than outgroup faces, whether the groups are racial or arbitrary.

We hypothesised that revealing the category (here: study fields) of students would lead fellow students to categorise them into in- vs. out-group members. Categorisation should be reflected in changes of pairwise similarity between these individuals. In a within-subject design, 20 participants were shown the faces of eight unknown students. Participants rated the pairwise similarity between these students based on facial features, social life, and personality. After the students' study fields were revealed, participants repeated the similarity ratings.

We found that after revealing the study fields, the average similarity between students of the same field increased, while the average similarity between students of different fields decreased. These findings were found in similarities of personality or social life, but not in similarities of facial features.

These results show that knowing the study field of students leads to them being categorised into two distinct groups by fellow students. In a pre-registered study, we are currently repeating the experiment accompanied with measures of the fMRI BOLD signal evoked during presentation of the student faces before and after knowing the study field. We expect that changes in neural representations of these faces will mirror the behavioural changes we observed.

Location: Cafeteria
Poster 18

Atari-playing Models of Anterior Cingulate Cortex

Thomas Colin, Clay Holroyd

The function of the anterior cingulate cortex (ACC) remains poorly understood, despite a growing catalog of hypotheses and models. It appears to play a role in motivation; cognitive control; cost, reward, or outcome detection and prediction; representing sequential behavior; etc. Whatever its role, evidence from lesion studies suggest that it is supportive to the production of behavior, rather than critical to it. Recent work from our lab suggests that ACC represents states of brain wide activity for the purpose of control. Here, we explore this hypothesis by training deep neural models, using a state-of-the-art reinforcement learning algorithm, on complex high-dimensional tasks: Atari games. An "ACC module" is added to perform a supportive role. This set-up allows for testing different types of "ACC modules" attaching to the same deep reinforcement learning model, whose role is to capture habitual behavior from perception to action. The use of a single "base" model enables comparison between different ACC modules. Furthermore, by using a complex, temporally extended task, some of the constraints of naturalistic decision-making are enforced. Among the modules tested, we present a predictive module that extracts temporal structure from lower-level behavior in order to enable higher-level strategizing and the exertion of control upon lower-level behavior. In a later phase of this project, we intend to test such models against human imaging data, using representational similarity analysis.

Location: Cafeteria

Poster 19

Autobiographical processing of geometric displays that reflect social proximity

Lize De Coster, Ana Pesquita, Brad Mattan, Pia Rotshtein

Our cognitive system is constantly confronted with the rich social environment around us. One important ability that helps us to navigate this complex environment effectively is our ability to reason about the relationships between ourselves and others. While research suggests that navigating knowledge of social relations may co-opt neural circuitry of mental representations of space, the neural mechanisms behind these processes remain unclear. In the current study, we aimed to investigate which brain areas are involved in creating spatial configurations of our social relationships. Participants assigned names to geometric figures, establishing two social dimensions: valence and relevance. These geometric figures were then spatially arranged to create visual displays that reflected either congruent or incongruent social maps along these dimensions. fMRI was recorded while participants performed an n-back task while watching these visual displays. Whole-brain analyses revealed that congruent displays were associated with increased activity in brain areas related to Theory of Mind and tracking of social relationships such as the medial prefrontal cortex, posterior cingulate cortex, and precuneus. Psychophysiological interaction analyses indicated that these areas showed increased connectivity with medial prefrontal areas linked to autobiographical processing. In contrast, incongruent displays resulted in increased activation in visuomotor areas in the parietal and occipital cortices. These results indicate that the same visual stimuli were processed differently (i.e. socially relevant or not) depending on their spatial organization. Furthermore, they provide important insights into how the brain creates spatial configurations of our social relationships, which shapes our cognition and behavior.

Location: Cafeteria
Poster 20

A Causal Examination of the Neural Substrates Underpinning Prospective and Retrospective Sense of Agency

Amber Pryke-Hobbes

Sense of agency (SoA) is the subjective feeling of ownership experienced over one's actions and their effects in the external world. Existing neurocognitive accounts of this experience propose that SoA is informed by both prospective and retrospective mechanisms, enabling individuals to integrate available contextual cues prior to (e.g., the number of available action choices) and following (e.g., the emotional valence of an action's outcome) the performance of a given action. The current study examined the causal role of two brain regions thought to be critical in monitoring and processing such agency cues, that is, the left-dorsolateral prefrontal cortex (l-dLPFC) and left temporo-parietal junction (l-TPJ). One-hundred-and-four participants received sham and anodal focal transcranial direct current stimulation (f-tDCS) to either the l-dLPFC or l-TPJ while performing an intentional binding paradigm in which both prospective (action choice) and retrospective (outcome valence) components of agency were manipulated. Preliminary findings indicate that across both target brain regions, anodal stimulation polarised participants' SoA over rewarding and punishing action outcomes. Specifically, we observed that SoA was strengthened by anodal stimulation when participants' actions were followed by a rewarding outcome and weakened when succeeded by a punishing outcome. We propose that retrospective components of agency are not processed in any one module of the brain, but rather across a dynamic neural network which synthesises available information from multiple neural regions to form an integrative experience of consciousness.

Location: Cafeteria
Poster 21

Social content mitigates the negativity bias in affective scene processing: Evidence from co-registered EEG and eye movements

Anna Fischer, Danilo Postin, Louisa Kulke, Pascal Vrtička, Anne Schacht

How do our brains represent visual exploration when images contain multiple relevant aspects? While the importance of emotionally evocative stimuli has been emphasized in the past, current perspectives emphasize the intrinsic relevance of social cues. The precise neural mechanisms involved in such processing remain unclear.

To investigate the temporal dynamics of neural processing of social and emotional relevance, we employed event-related potentials and eye-tracking measures. Twenty-seven female participants viewed complex visual scenes that varied in social content (social, non-social) and emotional valence (positive, negative, neutral). At the neural level, both relevancies unfold over time: Early Posterior Negativity (EPN) amplitudes were increased by social content, while subsequent P300 and Late Positive Component (LPC) amplitudes were largest for negative picture content. This well-established negativity bias was mitigated at initial sensory processing stages, indicated by boosted P1 amplitudes for images depicting positive social content. Eye movement measures revealed faster initial saccades for social images and an interaction of both relevancies in fixation patterns, indicating equal exploration of positive and negative social images.

The findings suggest that social and emotional relevance guide visual attention in a distinct and interactive manner across different stages of stimulus processing. The study supports appraisal theories by proposing a logical sequence of relevance checks, with social information processing preceding emotional valence processing. Additionally, the results emphasize the combined impact of socio-emotional information, demonstrating an early processing advantage for positive social images and questioning the idea of a generalized negativity bias.

Location: Cafeteria

Poster 22

Interpersonal synergy in co-constructing shared conceptual space

Rui Liu, Lara Bardi

Human communication has been formulated as an information compression problem, like decoding Morse codes with a predetermined codebook. However, a fundamental question is how we communicate when no codebook was given in the first place. Here, we investigate behavioral and neural dynamics of how interlocutors co-construct a signaling system from scratch. Participants played the Embodied Communicative Game (ECG) in dyads, meanwhile their EEG were simultaneously recorded. In each trial, each participant was given four colored objects. The dyad needed to choose the same colored object without knowing each other's color configuration. To signal their choices, each participant controlled the movements of an icon that was visible to both, and feedback was provided at the end of each trial. Participants' Autism-Spectrum Quotient (AQ) was measured after the game. We found that each dyad converged on their unique (movement-color) signalling system with their own pace. Co-construction of the signaling system is more reliably predicted by adjustment of the conceptual space of the interlocutors who had higher AQ in each dyad than that of the lower-AQ partners. Moreover, aperiodic EEG activity of the frontal-temporal electrodes tracked the communication dynamics, independent from task phases and movement made by the interlocutors. These results suggest that communication is not just two people doing the same thing at the same time, but relies on asymmetric interpersonal coordination between two minds, which may be associated with a fundamental change of the generative models of the interlocutors than with the specific visual input and sensorimotor output per se.

Location: Cafeteria
Poster 23

Investigating the relationship between dyadic person similarity and face judgement similarity

Rochelle Williams, Lúcia Garrido

Research shows that we use our own dispositions as frameworks to make judgements about others. Therefore, could it be that people who are similar in their dispositions also tend to make more similar social judgements? A consistent understanding of our social environment may provide foundations for social relationships, be it platonic or romantic. Here, we investigated whether similarities in personality and self-traits is related to this consistency, namely through face judgments about others. 248 participants based in the UK (ongoing data collection; pre-registered target of 300 participants) rated 24 faces on 6 social traits. Participants also rated themselves on 13 social traits and completed a 60-item personality questionnaire (IPIP-NEO-60). We computed dissimilarity between pairs of participants based on face judgments, self-trait ratings, and personality ratings, which resulted in three separate dissimilarity matrices (RDMs). Each RDM entry shows pairwise distances in ratings between participants. Using inter-subject representational similarity analysis, the three RDMs were then correlated with each other. Results showed that both the self-trait and personality RDMs were significantly correlated with the face judgement RDM ($\rho = 0.16$, $p < .001$ and $\rho = 0.20$, $p < .001$, respectively). These results indicate that people with more similar personalities are more likely to make similar social face judgements. These correlations are consistent across different sample sizes (using re-sampling). Importantly, these associations were stable even when controlling for age, gender, ethnicity, and geographical location. These findings may have implications for explaining how we affiliate with others, build connections and form relationships.

Location: Cafeteria

Poster 24

Modulatory effects of virtual and real tactile stimuli on subjective and EEG responses to pleasant touch and laser pain

Arianna Vecchio, Luca Provenzano, Salvatore Maria Aglioti, Martina Fusaro

Studies indicate that subjective and EEG responses to pain are modulated by actual pleasing touch. Moreover, using immersive virtual reality (IVR) we demonstrated that seeing slow touches delivered to an avatar—observed from a first-person perspective—are perceived as pleasant pretty much like real-life stimulation.

We expanded on this research by testing 30 participants received blocks of slow pleasant (3 cm/sec) and fast (30cm/sec) touches in real and IVR scenarios, followed by painful laser stimulation.

We recorded ERPs evoked by the real and virtual touches to test explore their differential processing and the ERPs evoked by the laser, to test whether the touches could have an analgesic effect on the induced pain. Moreover, we collected behavioural measures about the pleasantness of touches and the unpleasantness of the laser. Subjective reports indicate that slow touch was perceived as more pleasant than fast touch, both in real ($p < .001$) and IVR scenarios ($p < .001$). EEG results show that slow touch in real and IVR scenarios evoked a higher negative-late-potential on the frontal-central sites (500-1200ms) than fast touches ($p = .006$).

Moreover, laser-evoked P2 components over central electrodes (230-350ms), in index of pain processing, were decreased when preceded by virtual compared to real touches ($p = .01$). However, participants rated the unpleasantness of the laser similarly across conditions ($p > .05$). Our study demonstrates that virtual and real slow touches induce more positive ratings and modulate neural responses similarly. Moreover, virtual touches exhibit a potential analgesic effect, highlighting the role of virtual experiences in pain processing.

Thursday, May 23rd 2024 // 12:00pm - 2:00pm

Location: Cafeteria

Poster 25

Self-other dynamics in spontaneous interpersonal synchronization.

Kyveli Kompatsiari, Aliaksandr Dabranau, Ivana Konvalinka

Self-other integration and distinction play a vital role in efficient synchronization with other humans. Previous research has shown that in simple rhythmic joint action tasks (e.g., tapping), self-other integration can be described using mathematical models of coupled oscillators, representing within- and between-person action-perception links. The present study focuses on examining self-other behavioral and inter-brain dynamics (measured with dual-EEG) when synchronization is not the goal of the task but rather an emergent phenomenon in more complex continuous interactions. More specifically, participants produce improvised movements in a ‘mirror-game’ paradigm while being explicitly asked to synchronize with the partner (synchronized condition) or produce independent movements with visual feedback of each other (spontaneous condition). Mathematical models of coupled oscillators will be used to reveal emergent dynamics of self-other integration and distinction on behavioral and neural level. Moreover, we hypothesize that stronger interpersonal synchronization in the spontaneous condition will lead to stronger sensorimotor alpha and beta desynchronization and higher inter-brain synchronization.

Location: Cafeteria

Poster 26

Threat-induced prosocial behaviour: enhanced exogenous attention to protect others from harm

Maria Lojowska, Federica Lucci, Manon Mulckhuyse

As social animals, humans demonstrate prosocial behavior if they can prevent harm to others. However, to what extent prosocial behavior under threat engages less controlled cognitive processes to save the other remains unclear. Here we examined how threat exposure to an anonymous other modulates stimulus-driven attention. Individuals performed an exogenous spatial cueing task and their performance determined whether they themselves or the anonymous co-participant received electric shocks. Threat of shock to the co-participant as well as to the participants themselves resulted in faster orienting and reorienting responses than in the safe condition. This behavioral improvement was associated with increased pupil dilation when participants avoided the shocks to themselves as well as to the co-participant. Together, these results show that helping others avoid harm recruits automatic attentional processes and autonomic responses in a way that does not differ from individual exposure to harm.

*Location: Cafeteria
Poster 27*

Interpersonal Neural Synchrony and Coupling in Parents of Preschool Children: Insights from a novel fNIRS Hyperscanning Study

Anıl Karabulut, Ricky Chmitorz, Laura Mteweale, Luca Cecchetti, Ben Marlow, Pascal Vrtička,

Social neuroscience research on parent-child interaction increasingly employs hyperscanning, which assesses both parents' and children's brain activity during social interaction to measure neural coherence. Using functional near-infrared spectroscopy (fNIRS) hyperscanning in our SoNeAt Lab, we consistently find increased neural coherence in parent-child dyads during problem-solving and free verbal conversation.

Despite such insights, many details about neural coherence during parent-child interaction remain unclear. In this new fNIRS hyperscanning study that is currently underway (N=60 families, children's age 4-8 years), we aim at addressing these gaps by introducing several new elements.

Most previous studies only looked at neural coherence in mother-child or father-child dyads and not the entire mother-child-father triad. Consequently, data on the important contribution of mother-father neural coherence is crucially missing. We specifically focus on parents' neural coherence during mother-child-father triadic interaction.

Furthermore, previous experimental designs inconsistently employed acquisition of participants' brain activities either during direct social interaction yielding interpersonal neural synchrony (INS), or during exposure to the same external stimuli (e.g., images or movies) yielding interpersonal neural coupling (INC). We measure parents' neural coherence during mother-child-father interaction and also while parents are shown video-recordings of the interaction to directly compare INS and INC.

Finally, most previous studies only looked at INS or INC without additional behavioural or physiological coherence measures only allowing for limited insights into more global bio-behavioural synchrony (BBS). We complement INS and INC measures with coherence in physiology (heart rate), behavioural coding as well as subjective emotional ratings.

Preliminary data will be available for the conference.

Location: Cafeteria
Poster 28

Event-Related Potentials to Simple, Complex and Social Tactile Stimulations

Mohammad Riaz, Hardion-Carrias Robin, Kate Loidolt, Marianne Latinus, Claire Wardak

Research in tactile electrophysiology mostly relies on electrical or robots-delivered stimulations which prevent the investigation of the neurophysiological response to social aspect of touch despite its crucial role through lifetime.

This study aimed to compare event-related potentials (ERPs) generated by different tactile stimulations of the radial nerve. Two distinct protocols were tested on the same 24 adults, each testing a different type of stimulation of the hairy forearm: tapping and stroking.

In the tapping protocol, participants received brief mechanical stimulations delivered automatically by a tactor ("simple condition"), or by an experimenter using the index ("social condition") or a soft Velcro-like object around the finger ("complex condition"). In the stroking protocol, participants received gentle strokes (CT-optimal) delivered by the experimenter's index ("social condition") or the same object as in the tapping study ("object condition"). We performed both a somatosensory ERPs and a spatial-temporal analysis.

Results revealed that in the tapping protocol, all stimuli elicited comparable responses with distinctive P50, N80, N130 and P200 components. In the stroking protocol, an ultra-late potential occurring around 2 seconds after stimulation onset was sensitive to the nature of the stimulation: it peaked earlier for the social condition than the object condition.

Overall, these findings suggest that brief tactile stimulations reliably evoked similar ERPs, regardless of the condition. Continuous stimulation evoked an ultra-late potential sensitive to the type of stimulation. This study highlights the feasibility of measuring ERPs evoked by direct skin-to-skin contacts, allowing to ensure ecological validity and to study affective/social touch processing.

Location: Cafeteria
Poster 29

The influence of autism-like traits on the social dynamics of joint improvisation: insights from the Mirror Game

Yasemin Abra, Christine Falter-Wagner, Irene Sophia Plank

Growing research explores motor coordination difficulties in Autism Spectrum Disorder (ASD), demonstrating reduced spontaneous synchronization and voluntary coordination with typically-developing interaction partners. These phenomena have mostly been explained through intra-individual mechanisms within the autistic person in the interaction. However, it is not only processes within individuals but also the ways in which individual traits and skills align with and affect the interaction partners that determine coordination performance and experience.

The Mirror Game paradigm allows to explore the dynamic aspects of joint improvised action and the potentially (a)symmetrical mutual contributions of interactants. In this study, we aim to use the dyadic full-body Mirror Game to investigate the intra- and inter-individual mechanisms and traits contributing to coordination performance and experience. Using mobile eye tracking, we also probe the influence of these mechanisms and traits on dynamic attentional selection. We expect objective coordination and the subjective experience thereof to vary as a function of interpersonal similarity in autism-like traits and empathy. Preliminary results will be available for discussion.

Given the often-blurry distinction between neuro-typical and diverse behavior within the general population, this study focuses on typically-developing individuals and their dimensional autism-like traits. With this basic research study, we hope to gain insights into the applied social dynamics of coordinated nonverbal interactions to subsequently investigate these processes in an autistic population.

Location: Cafeteria
Poster 30

Interpersonal Motor Synchrony and Self-Other Processing

Chloe Bates, Andrew Martin

Interpersonal synchronous movement between dyads may result in a blurring of self-other representations. However, another theoretical position claims that synchrony sharpens the distinction between self and other due to improved social attention. Inconsistencies in existing literature may stem from task variations or overlooking individual differences in social interactive styles. Thus, this research aimed to investigate dyadic self-other processing across two tasks following synchronous or asynchronous finger-tapping. Moreover, we measured social dominance to investigate whether socially dominant individuals are less influenced by synchronous movement.

We recruited 108 participants organized into 54 dyads, with each dyad assigned either a synchronous or asynchronous finger-tapping task. Subsequently, participants engaged in an item and source memory task, recalling adjectives related to themselves or their partners, and an emotional egocentricity task involving both dyad members. Social dominance was assessed using the Personality Research Form E subscale.

Results revealed self-referential biases in memory and emotion. Synchronous movement enhanced source memory for both self and partner-encoded words, supporting the improved social attention hypothesis. Social dominance interacted with synchronicity such that only the non-dominant member of the dyad displayed greater self-other blurring. Synchronous movement had no effect on the emotional egocentricity bias.

Our findings find support for both theoretical positions, dependent on the social dominance of the individual in question. Further analyses exploring the effect of lag in finger-tapping and subsequent self-other processing are ongoing, with analyses focused on leader-follower relationships between the dyads.

Location: Cafeteria
Poster 31

Is loneliness linked to social decision making? Multimodal investigation using EEG, fMRI and experience sampling methods.

Monika Malon, Łucja Trzeciak, Szymon Mąka, Łukasz Okruszek

Recent studies noted that while loneliness may encourage reconnection with others, it may also increase focus on self-preservation, resulting in egocentric behavior and decreased propensity to act in favor of collective interests. Surprisingly, only a handful of studies have examined the association between loneliness and social decision-making. This project aims to cover this gap by conducting a multimodal analysis of neural, ecological and longitudinal data.

45 high lonely (HL) and 45 low lonely (LL) individuals will take part in behavioral, EEG and fMRI sessions. During neural data acquisition participants will play an iterative Prisoner's Dilemma (PD) against a 'tit-for-tat' algorithm masked as another human player. Participants will also complete a 7-day experience sampling measurement of everyday social activity and prosocial behaviors via smartphones and follow-ups after 6 and 12 months. To analyze spatiotemporal components of neural activity during PD, Event-Related Potentials, together with spatial maps of brain activity will be used for joint ICA decomposition. These results, along with data from everyday life and follow-ups will be utilized to create a multimodal model of social decision-making in HL and LL individuals.

Presented study design, including both laboratory and ecological, as well as both long- and short-term measurements will provide an exhaustive investigation of the relationship between prosociality and loneliness that may help to settle discrepancies found in up-to-date research. Furthermore, the study will be carried out as a part of a larger project and will inform later stages of the project, including a hyperscanning study.

Location: Cafeteria
Poster 32

Resistance to immoral orders: can we prime disobedience?

Louise De Meulenaer, Emilie Caspar

Milgram's obedience experiments highlighted the influence of situational and social factors on behaviour. Caspar (2021) introduced a novel paradigm devoid of cover stories, adaptable to neuroscientific methods, focusing on disobedience research. Their findings revealed that awareness of Milgram's experiment is not the primary determinant of participants' decisions to (dis)obey, despite explicit mentions during the experiment. This led us to explore whether priming (dis)obedience could impact behaviour and specific neural aspects. Conducting a neuro-behavioural between-subject study, we will explicitly prime (dis)obedience in participants. The second study aims to prime disobedience either implicitly or explicitly. These studies collectively address the research question: 'Can we prime prosocial disobedience?'. Each study will involve approximately 80 participants (we are working with dyads), employing the same paradigm as introduced by Caspar (2021). While results are pending, we anticipate observing effects in both brain activity and behavioural responses due to the priming of disobedience. We will take a closer look at the actual rate of disobedience, feeling of Responsibility, Empathy and Sense of Agency, as well as ERP components and specific brain waves on the EEG. This research contributes to my PhD's overarching theme: an exploration of neurocognitive processes and disobedience to immoral orders, providing insights and potential interventions to increase resistance. Understanding these dynamics provides valuable insights for navigating moral dilemmas and developing interventions to enhance prosocial resistance. By unravelling the intricacies of priming effects on behaviour and neural responses, this study contributes to our understanding of human decision-making in morally challenging contexts with real-world applications.

Location: Cafeteria

Poster 33

Socially Influenced Preference Revaluation: Insights From Rat Studies

José Doeren

Social learning is crucial in various social species as it enables individuals to acquire valuable information from others. Through a simple adaption in the widely used Social Transmission of Food Preference (STFP)-task, we obtained quantitative measurement about the degree of social influence on innate choices. First, test rats (TR) reveal a preference for one of two flavored food types in a non-social context. Subsequently, they are paired with a demonstrator which had recently been fed with TR's lesser preferred flavor. Following social interaction, TRs preferences are scored again. It was shown, that TR are enhancing the intake of the demonstrated food, hinting to its re-evaluation by coupling with a social stimulus. This naturalistic set-up requires the cognitive ability to flexibly integrate socially cued information. To disentangle the neuronal basis of this behavior, we utilized rats transgenic for the Disrupted-in-schizophrenia1 (DISC1) protein, which is highly associated with disturbed dopamine signaling. We uncovered a distinctive disability in DISC1-rats to appropriately implement social information. We show that, while wildtype rats exhibited increased consumption of demonstrated flavor following social interaction, DISC1-rats failed to up-value socially cued food. This deficit was not attributed to impaired social exploration, odor discrimination, or disruption in reward and reversal learning. Thus, the DISC1-phenotype in the adapted STFP sheds light on overlooked behavioral symptoms specific to DISC1's influence on social learning and preference revaluation, without affecting other dopamine-related behavioral domains. In addition, these results yield first steps toward unraveling neurobiological mechanisms underlying the valuation of other opinions in social learning.

Location: Cafeteria

Poster 34

Social Decision Making in Loneliness: A Hyperscanning EEG Pilot Study of the Prisoner's Dilemma

Łucja Trzeciak, Łukasz Okruszek

The planned study investigates the neural underpinnings of social decision-making in individuals experiencing varying levels of loneliness. Loneliness, a significant modern health concern, is hypothesized to affect individuals' decision-making in social contexts. Given the growing emphasis on the ecological validity of experimental paradigms, real-life interaction between two participants taking part in the naturalistic version of the Prisoner's Dilemma (PD) task against each other will be used to study real-life interaction in the laboratory setting.

We will employ hyperscanning EEG setup to examine neural synchrony in dyads comprising high-lonely (HL) and low-lonely (LL) individuals during the iterated PD task. We plan to recruit 180 participants, matched into 90 dyads (30 HL+HL, 30 LL+LL, 30 HL+LL). The procedure will include both face-to-face and face-blocked conditions to assess the impact of nonverbal communication on cooperation and neural synchrony during the task. Anticipated results include observable differences in behavioral measures and inter-brain synchrony patterns, with HL dyads expected to show reduced inter-subject coupling compared to LL dyads.

Furthermore, utilizing the SABI (Structure, partners A and B, Interaction) framework, we will analyze impact of the appraisals of the situation structure in the PD task (e.g. interdependence, conflict of interest), participant's psychological (e.g. Agreeableness & Honesty-Humility) and physiological (e.g. vagal tone) characteristics on the interaction features. This approach highlights our commitment to ecological validity. The findings are expected to offer valuable insights into the neurobiological aspects of loneliness and its effects on social interaction dynamics, contributing useful knowledge to the field of social neuroscience.

Location: Cafeteria
Poster 35

INFORMATION ABOUT OTHERS' RATINGS CHANGES WILLINGNESS-TO-PAY FOR FOOD ITEMS

Ana Defendini, Leonie Koban, Hilke Plassmann

Human food decisions are influenced by many factors, including taste and health considerations, culture, and social context. Social influences on food choices are well established and could provide useful tactics to nudge people towards healthier food consumption. Yet, the brain mechanisms by which social information affects food craving and food-related decision-making remain incompletely understood. In this study, we used functional magnetic resonance imaging (fMRI) while participants completed a dietary decision-making task, in which they rated their willingness-to-pay (WTP)—an incentive-compatible behavioral measure of craving—for different food items. In some trials they were exposed to social ratings, i.e., other people's WTP for these food items, which were selected to be either high or low on average. We found that high compared to low social WTP ratings increased participants' WTP for food items. Presence of both high and low (compared to no) social information increased activation of the dorsal medial prefrontal cortex, dorsolateral prefrontal cortex, and intraparietal sulcus, paralleling previous findings for social information effects on pain. To test potential drivers of the behavioral change observed in participants' WTP, we applied an independently developed neuromarker of craving, the neurobiological craving signature (NCS) and provide evidence that neural responses of craving predict WTP of food items. Overall, our study provides new insights on the mechanisms by which social information can affect valuation and food choices, and confirm the NCS's ability to predict craving across foods.

Location: Cafeteria

Poster 36

How Social Agency differs from Sense of Agency across different action-effect intervals

Crystal Silver, Ben Tatler, Rama Chakravarthi, Bert Timmermans

Sense of Agency (SoA) is the responsibility felt over actions and their effects, called Social Agency (SA) in social contexts. Whether and how SA differs from SoA is largely unknown, especially in direct social interaction: the others' reaction is the effect of my action. We compared SA and SoA across two experiments, manipulating action-effect intervals (200-2100ms). For experiment one SA participants were told they were interacting with a partner via webcams, SoA participants were told they were interacting with videos. In reality, all participants were interacting with videos. Participants pressed a key at a time of their choice, then watched a hand on screen do the same after a certain interval. SA/SoA were measured explicitly by participants rating how related the reaction was to their action. SoA exceeded SA for short intervals, then linearly decreased as interval duration increased. In contrast, SA results increased over interval durations, peaking around 1000ms before decreasing. Results suggest that the SA/SoA relationship is modulated by action-effect intervals. Experiment two modified the paradigm for electroencephalography (EEG) using simplified coloured dot stimuli as a visual proxy for the timing of the partner's action instead of using hand videos; pilot behavioural results replicated experiment one. Data for experiment two is still being collected, exploratory EEG Event Related Potentials (ERP) analysis will be shared to reveal if there are distinct neural correlates for SA and SoA.

Location: Cafeteria
Poster 37

Self-referencing differently undermines detection of personal vs. ideological lies

Gianmarco Convertino, Mara Stockner, Jessica Talbot, Giuliana Mazzoni

Seminal studies show that inconsistency between detectors and deceivers, in ideological opinion on controversial topics, impairs lie detection. In the forensic field, however, deceptions refer more to personal experience, than ideological opinions. To directly test the impact of agreement for personally vs. ideologically justified opinions as a modulator of accuracy in detecting deception, forty-eight statements (half true) were recorded in videos, and randomly administered in Experiment 1 to 102 participants (56 females). Each statement reported an opinion (agree vs. disagree) and its justification (personal vs. ideological). In Experiment 2 (ongoing), each video is divided and presented in two parts (opinion and justification). Participants ($n = 120$) are assessed for the base rate of their ability to detect deception, assigned to a sequential vs. random order of exposure to the videos, and asked to judge each stimulus as truthful vs. deceitful. While self-referential processes were shown to impair the detection of ideological lies, in Experiment 1 we show that the effect of self-referential processes extends to personally justified lies, and opinion content (agree vs. disagree) specifically predict the detection accuracy for personal vs. ideological account. In Experiment 2, we expect the random order of presentation to improve performance in the inconsistent situations. The study reveals the complex, non-univocal role of self-referencing in detecting deception.

Location: Cafeteria
Poster 38

Exploring neural connectivity and executive function in socially vulnerable individuals

Renzo Lanfranco, Fabienne dos Santos Sousa, Pierre Wessel, Álvaro Rivera-Rei, Tristán Bekinschtein, Boris Lucero, Andrés Canales-Johnson, David Huepe

Efforts to understand the neurocognitive features of both healthy and clinical populations have been substantial, yet there remains a significant gap in our knowledge regarding socially vulnerable individuals. Despite their heightened susceptibility to neurocognitive disorders, the neurocognitive characteristics of this population have largely eluded exploration. Socially vulnerable individuals, defined by social deprivation, low socioeconomic status, chronic social stress, and poor social adaptation, typically exhibit poorer executive functioning compared to their peers. However, studies focusing on healthy but socially vulnerable groups are lacking. In this study, we investigated whether neural power and connectivity signatures could elucidate executive functioning in healthy yet socially vulnerable individuals, providing insights into the impact of chronic stress and social disadvantages on cognition. Resting-state electroencephalography and executive functioning were measured in 38 socially vulnerable participants and 38 matched controls. Using a variety of statistical tests, we explored neural power and connectivity while accounting for different demographical, cognitive, and social individual differences. We found that neural power did not offer informative insights, while lower delta and theta phase synchrony were associated with impaired executive functioning across all participants. Notably, the socially vulnerable group exhibited higher delta phase synchrony compared to the control group. Moreover, delta phase synchrony, in conjunction with years of schooling, emerged as the most reliable predictors for identifying socially vulnerable individuals. In summary, our findings suggest that exposure to chronic stress linked to socioeconomic factors and educational deficits is associated with alterations in slow-wave neural connectivity and executive functioning.

Location: Cafeteria

Poster 39

Neural mechanisms of political polarization: a review and EEG-study of biased processing of faces of inparty and outparty leaders

Gustavo Couto de Jesus, Maaïke Homan, Diamantis Petalas, Joe Bathelt, Gijs Schumacher, Bert Bakker

Polarization is identified by many as a dangerous development that could potentially undermine human flourishing. Polarization is driven by ingroup favoritism and outgroup antagonism. Yet, the neurobiological mechanisms behind polarization are relatively unknown. In this study, we investigate the pre-conscious neuromarkers evoked by seeing faces of the leaders of the political ingroup and outgroup. To generate our hypotheses, we have systematically reviewed studies exploring group dynamics in face presentation paradigms that apply Event-Related Potential (ERP) methodology. Studies outside the domain of politics suggest increased P200 amplitude as a sign of attention allocation indicative of prejudice towards the outgroup, and increased N200 amplitude as a sign of inhibition and/or familiarity towards the ingroup. These hypotheses will be tested using electroencephalographic data collected in a previous project by other members of our lab. In this study, Dutch participants (N=51) were asked to pick 2 parties they would preferably vote for and 2 parties they would not vote for, thereafter being exposed to the faces of the respective leaders (T=48). None of the authors has accessed the data. We will preregister to pre-process the collected data using a hands-free python pipeline and test our primary hypotheses about the P200 and N200. Sensitivity analyses indicate sufficient power. We will test for differences of ERP amplitude between inparty/outparty conditions. By analyzing which potentials from group dynamics studies can be replicated in the political domain, we generate hypotheses for further testing, and help to elucidate the neural mechanisms of polarization.

Location: Cafeteria

Poster 40

Individual and collective decision-making on moral dilemmas investigated with EEG hyperscanning

Eva Vives, Nicolas Coucke, Emilie Caspar

Moral dilemmas are situations that elicit moral conflict in individuals, as they involve choosing between two mutually exclusive options with opposing moral values. Despite their direct relevance to real-life situations, moral preferences have so far been mostly studied in isolated settings, overlooking real-life social dynamics. The impact of social presence and social interactions on decisions about moral dilemmas remains largely undocumented in the existing literature. Nevertheless, the most critical moral scenarios, such as those involving sparing or killing other people, are rarely made in isolation. To address this critical gap, we designed an experiment that aims to examine the processes underlying moral decision-making between utilitarian and deontological actions in a social context. This social context is induced by pairing participants into face-to-face dyads. During the task, participants are presented a series of moral dilemmas on a screen. They first report their response privately on an external device (alone trials) and then make a collective decision after reaching a consensus (social trials). Simultaneous EEG hyperscanning recordings of the two participants are made during the whole task. In terms of behavioral results, we expect that participants will 1) adjust their decisions to match those of their interaction partners, and 2) increase the proportion of utilitarian choices. In terms of EEG data, we expect moral conflict (quantified as mid-frontal theta activity) to increase when participants' social decisions are incongruent with their personal moral views.

Location: Cafeteria

Poster 41

Impact of Empathy and Agency Neurocognitive Processes on Prosocial Disobedience: A Causal Investigation using Transcranial Direct Current Stimulation in Civilians and Military Cadets

Evelyne Fraats, Michael Nitsche, Emilie Caspar

The tragedies of World War II stand as a testament to the fact that most horrendous acts are committed in the name of obedience. Although resistance by individuals against immoral commands has been acknowledged, the specific cognitive factors driving such resistance remain uncertain. Building upon previous research linking Sense of Agency (SoA), empathy for pain, and resistance to immoral commands, the main aim of the current study is to shed light on the causal mechanism of SoA and empathy for prosocial disobedience using transcranial direct current stimulation (tDCS). Participants will undergo tDCS targeting the middle frontal areas linked to SoA, or the somatosensory cortex linked to empathy for pain, while participating in a prosocial decision-making task, with concurrent EEG recording. Both behavioural and neural results will be assessed for the effects of tDCS manipulations on civilians and military personnel specifically. Expected outcomes include an increase in prosocial disobedience, and elevated levels of empathy towards pain (measured with subjective ratings and late ERP amplitudes) during anodal stimulation, with the opposite expected during cathodal stimulation. Furthermore, an increased SoA (measured with temporal interval estimations and mid-frontal theta activity) is expected during anodal tDCS and the opposite during cathodal tDCS. This approach may provide causal evidence for the importance of SoA and empathy for pain concerning prosocial disobedience and highlight differences between civilians and military individuals. Ultimately, this research may serve as a foundational element for future endeavours aimed at developing strategies to eliminate unethical decision-making stemming from blind obedience to authority figures.

Location: Cafeteria

Poster 42

The Impact of Digital Voice Agents on Trust and Roles Within a Household

Aline Moore Lorusso, Ruud Hortensius, Melissa Jansen, Ghislaine van den Boogerd

Digital voice agents (DVAs) aid in the task to provide information for the user and while they are part of a social system, earlier research has not analysed or ignored how DVAs impact social systems. This study investigates how long-term DVA usage affects trust and roles of the users and their household. Using a multi-methods approach, we measure behavioural and self-report aspects of trust, map the dynamic position of a DVA in the household, and the impact of the roles of household members across three experiments (combined $n > 250$). Preliminary results suggest that the position of the DVA in the household is relatively stable, with minimal impact of long-term use and stable use across domains (knowledge, social, domestic, and entertainment usage). In contrast to this, the dynamics between household member change, especially with long-term usage. Together, these results suggest that while the relationships towards DVA might be stable over time, effects of DVA on household relationships are present.

Location: Cafeteria
Poster 43

From Spatial Navigation to Mental Navigation: Developing a Unified Theory of Cognition

Mykyta Kabrel

The cognitive maps, supported by the hippocampal-entorhinal system, facilitate spatial navigation. However, recent studies indicate that place and grid cells encode not only physical spaces but also abstract categories. Additionally, similarities have been observed in cognitive, computational, and phenomenological features of episodic memory and egocentric navigation, as well as semantic and spatial search behavior. These findings suggest the existence of "conceptual maps" alongside spatial maps. Once individuals acquire a model of the world, they can navigate it offline, employing spatial navigation skills for navigating mental representations beyond spatial domains. Here, we aim to develop a comprehensive theory of cognition based on our capacity for mental navigation, aiming to engage researchers and inspire further experimental studies. Drawing on recent neuroimaging studies, we analyze how mental navigation may underlie key domains of higher cognition, such as problem-solving, decision-making, reasoning, and self-analysis. Subsequently, we present the results of our own study. Analyzing large text corpora, we demonstrate that during tasks involving abstract problem-solving, there is an increased use of spatial and navigational concepts (e.g., "going in circles" or "being at a dead end") as opposed to regular conversations. We hypothesize that this heightened use of spatial language depends on the activation of cognitive maps during tasks requiring mental navigation of one's conceptual space. In essence, we employ the cognitive and neural mechanisms of spatial navigation to navigate our thoughts and ideas, bringing forth a phenomenology resembling navigation and associated spatial metaphors. Consequently, we urge cognitive neuroscientists to test this theory using fMRI.

Location: Cafeteria
Poster 44

The role of contrast emotions in response inhibition

Rashmi Gupta

Previous studies examined the role of irrelevant emotional facial expressions in response inhibition. Irrelevant emotional faces would facilitate or inhibit response inhibition, depending on how these faces are paired with different emotional faces. In previous studies, angry faces were either paired with neutral, happy, or fearful faces in the response inhibition task, potentially leading to mixed results. This is the first study where all four irrelevant emotional faces (happy, angry, fearful, and neutral) were used simultaneously and presented in the same block as a stop signal in the stop signal paradigm. Participants were required to respond to the go signals (discriminate between X and O). Occasionally, a stop signal with irrelevant facial expressions (happy, angry, fearful, or neutral) was presented, where participants were required to withhold their motor response. All stop signals with irrelevant emotional facial expressions in comparison to neutral facial expressions interfered with the response inhibition process. Our results extend previous findings by suggesting that approach and avoidance reactions to facial expressions depend on the contrasting emotions presented in the task. The finding helps explain many inconsistent results with respect to the effect of emotions on response inhibition reported in the literature. It also suggests that the role of valence (emotional vs nonemotional) needs to be considered in determining inhibitory control. These results have theoretical implications for understanding the nature of emotions and their interaction with cognitive control functions.

Location: Cafeteria
Poster 45

Investigation of the Effects of Individualized Theta tACS on Cognitive Functions and EEG in Adult ADHD: Preliminary Results

Hansa Senturk, Tuba Akturk, Lutfu Hanoglu

Introduction: In Attention Deficit Hyperactivity Disorder (ADHD), it is well known that attention is disrupted, leading to an impact on working memory. Literature presents contradictory findings regarding the non-invasive neuromodulation of ADHD patients to improve their impaired attention-related cognitive functions. Building on previous studies that demonstrated the efficacy of individualized theta transcranial alternating current stimulation (tACS) in enhancing working memory in healthy adults, here, we aimed to investigate the effects of individualized theta tACS on cognitive functions and related-EEG features in ADHD patients.

Methods: 10 adults who met the clinical criteria for ADHD were included and assigned into two stimulation groups (active and sham) randomly. Neuropsychological tests (assessing memory and attention) and EEG recordings during both resting-state and visual memory task were obtained both before and after the tACS session. Each participant received 2 mA tACS 1 Hz slower than their individual theta frequency (ITF-1 Hz), for 20 mins, over the left fronto-parietal network.

Results: While there is a significant decrease in the left fronto-central theta power of sham group ($p < 0.05$), in the post-EEG measurement, the theta power remained the same in active group ($p > 0.05$). Backward digit span score, which shows attention and working memory, was significantly increased ($p < 0.05$) in the active stimulation group after the tACS, whereas no statistically significant effects were seen in the sham group.

Conclusion: The preliminary results of the current study indicate that individualized theta tACS might be a promising neuromodulation technique in the treatment of ADHD by increasing attention of the individuals.

Location: Cafeteria

Poster 46

The influence of face-ethnicity on word recognition: a cognitive pupillometry study

Anna Lorenzoni, Giulia Calignano, Eduardo Navarrete, Mario Dalmaso

Ethnicity plays a substantial role in shaping the way faces are perceived. At the same time, several social factors seem to influence word recognition. However, there is currently a lack of research investigating whether word recognition is influenced by the ethnicity of concomitant facial stimuli. In a lexical-decision task, 48 Italian participants were presented with words and non-words along with Caucasian (ingroup) or Asian (outgroup) faces. Participants saw a face for 2000ms, followed by a linguistic-stimulus and decided whether the string of letters represented a word or a non-word in their native language (Italian). Reaction times were faster for words with respect to non-words (lexicality-effect), and for high-frequency with respect to low-frequency words (frequency-effect). Results also showed greater pupil dilation indicating increased attentional engagement towards outgroup-faces compared to ingroup-faces. Then, when the linguistic stimulus was presented, a first interaction was observed showing that pupil dilation was greater for words with respect to non-words when presented with an ingroup-face. The opposite emerged by presenting an outgroup-face. In addition, a substantial interaction was observed showing greater pupil dilation for high-frequency with respect to low-frequency words, only for outgroup-face. We interpreted these interactions as an indication that word-recognition processes (words and high-frequency words) can be dramatically affected by face-ethnicity. Our results allow us to interpret the cognitive pupillary-response as an index of word recognition influenced by the ethnicity of the face. The data from this study provides early support for the idea that social cues influence an automatic process such as word recognition.

Location: Cafeteria
Poster 47

Dopamine D2 receptors and resting-state functional connectivity as predictors of fear extinction – a simultaneous PET-fMRI study

Ashika Anne Roy, Johan Vegelius, Johannes Björkstrand, Mark Lubberink, Mats Fredrikson, Fredrik Åhs, Andreas Frick

The neurobiological correlates of fear extinction are not fully elucidated. We tested the hypotheses that dopamine D2 receptor levels are related to resting-state functional connectivity and that both of these measures are predictive of fear extinction in the periphery (skin conductance responses; SCR) and the brain (functional magnetic resonance imaging; fMRI).

Fifteen healthy adults (mean±SD age 25±5.2 years, 9 females) underwent continuous 90 minute bolus+infusion ¹¹C-raclopride positron emission tomography (PET). Dopamine D2 receptor binding potential (BP(ND)) in the subregions of amygdala and striatum were calculated from the initial 50 minutes with the simplified reference tissue model and cerebellum as reference region. Simultaneous resting-state fMRI was collected for 7 minutes during the same time-period. Following these, participants underwent a 20-minute differential fear conditioning paradigm with one reinforced conditioned stimulus (CS+) and one non-reinforced (CS-). After completion of PET, participants underwent fear extinction with unreinforced CS+ and CS-.

Ventral striatum dopamine D2 receptor BP(ND) was positively associated with resting-state functional connectivity (rsFC) between the right amygdala and the default mode network. An interaction between CS and trial for SCR indicated fear extinction in the whole group. There was also an interaction between amygdala D2 BP(ND) and CS for SCR, such that lower amygdala D2 BP(ND) predicted greater differentiation between CS+ and CS-, indicating that lower dopamine D2 levels were associated with a delay in fear extinction.

We show that amygdala dopamine D2 receptors contribute to extinction of conditioned fear, further highlighting the role of dopamine in conditioned fear and its extinction.

Location: Cafeteria
Poster 48

Hypervigilance strikes a balance between external and internal attention

Nan Wang, Gilles Pourtois, Sam Verschooren, Luc Vermeylen, Ivan Grahek

Hypervigilance is an emotional state involving increased scanning of the environment to facilitate the detection of possible threats, which is often unlocked by stimuli presented in the external world. Accordingly, this state is mostly bound to external attention and as a corollary, it might be detrimental to internal attention and further affect attentional control defined as the ability to switch dynamically between these two domains. In current study, we aimed to address this question and induced hypervigilance in 49 healthy participants through the presentation of a task-unrelated aversive sound while they performed the switch attention task (SAT), which was previously devised to study attentional control. The skin conductance response results, as well as subjective ratings, confirmed that this manipulation was successful. At the behavioral level, hypervigilance led to a more symmetric balance between internal and external attention compared to a control condition where a safe sound was played and attentional control was asymmetrical. Moreover, using a drift diffusion model, we found that hypervigilance mostly influenced (i.e. slowed down) the drift rate for internal repetition trials, suggesting that maintenance in working memory could be jeopardized by this affective state. Currently, we are running an EEG experiment to pinpoint the processing stage(s) during which hypervigilance alters attentional control.

Location: Cafeteria
Poster 49

Cerebellum gray matter volume and fear conditioning across neurodevelopmental stages

Patricia Gil-Paterna, Johanna Motilla Hoppe, Ebba Widegren, Johan Vegelius, Daniel S. Pine, Karin Brocki, Malin Gingnell, Andreas Frick

Fear conditioning processes underlying the formation and persistence of fear memories change during the course of development. Most prominently, adolescents seem to exhibit impaired extinction and heightened fear retention after extinction. Adolescence is also a period of elevated onset of anxiety disorders. The neurobiological underpinnings of age-related changes in fear extinction and retention remain largely unknown. However, protracted development of the prefrontal cortex and its connections with the amygdala has been suggested. Recent work has linked the cerebellum to fear conditioning, which may provide additional clues to age-related differences in fear conditioning, given the changes in cerebellar morphology occurring during development.

This study will use a cross-sectional sample to explore age-related changes in cerebellum subregional gray matter volume (GMV) and fear conditioning, and their interrelation. Healthy children (n=35; 60% females; age mean=8.1 years), adolescents (n=41; 51% females; age mean=13.6) and adults (n=44; 52% females; age mean=34.8) underwent a 2-day Pavlovian fear conditioning task including fear acquisition, extinction and a retention test, and structural magnetic resonance imaging in a 3T scanner. Manual and automatic segmentations of cerebellar subregions will be conducted and age-group differences in GMV and skin conductance responses (SCR) to conditioned stimuli will be tested along with the relations between cerebellar GMV and SCR.

This study will provide insights into the potential role of cerebellum GMV in fear conditioning and how this changes with age. In extension, findings will shed light on the neural mechanisms contributing to the pathogenesis and maintenance of anxiety and fear-related disorders.

Location: Cafeteria
Poster 50

The modulating role of impulsivity and sensitivity to reward on moral decision-making under time pressure

Fiorella Del Popolo Cristaldi, Grazia Pia Palmiotti, Nicola Cellini, Michela Sarlo

Making timely moral decisions can save a life. However, literature on how moral decisions are made under time pressure reports conflicting results. Moreover, it is unclear whether and how moral choices under time pressure may be modulated by personality traits like impulsivity and sensitivity to reward and punishment. To address these gaps, in this study we employed a moral dilemma task, manipulating decision time between participants: one group (N = 25) was subjected to time pressure (TP), with 8 sec maximum time for response, the other (N = 28) was left free to take all the time to respond (noTP). We measured type of choice (utilitarian vs. non-utilitarian), decision times, self-reported unpleasantness and arousal during decision-making, and participants' impulsivity and BIS-BAS sensitivity. We found no group effect on the type of choice, suggesting that time pressure per se did not modulate moral decisions. However, impulsivity mediated the impact of time pressure, with individuals higher in cognitive instability (i.e., a specific facet of attentional impulsivity) showing slower response times under no time constraint. This suggests that time pressure may counteract the slowing effects of cognitive instability, possibly by maintaining attentional focus and thus reducing the cognitive-emotional conflict. In addition, higher sensitivity to reward predicted a higher proportion of utilitarian choices regardless of time available for decision, indicating that within sacrificial moral dilemmas the number of lives saved can be effectively reframed as a reward to be pursued.

Location: Cafeteria

Poster 51

Potential cognitive impairments after cardiac arrest

Sara Chergia, Magdalena Wlad, Eirik Alnes Buanes, Jørund Langørgen, Ing-Marie Larsson, Ewa Wallin, Sten Rubertsson, Lisa Ekselius, Malin Gingnell

Cardiac arrest (CA) survivors experience an ischemia-reperfusion injury in the brain and body with the potential to severely impair cognitive function, not only during the acute phase but also in the aftermath of the CA. However, our knowledge of the biological underpinnings of this process is unclear. The aim of this study is to measure the impact of a cardiac arrest on brain function, specifically cognitive function. In this case-control study, patients (n = 30, age range: 19-70, 26,6% females) who experienced a CA six months earlier and age-matched healthy control participants (n = 21, age range: 24-68, 40% females) were compared regarding cognitive function. Cognitive performance was assessed through a computerised neuropsychological test battery as well as through functional magnetic resonance imaging (fMRI) with a cognitive task to compare brain function in the two groups. The results of this study might provide a better understanding of the impact of CA on brain function and valuable information about prognosis that may be used to improve the rehabilitation process in survivors.

Location: Cafeteria
Poster 52

Predictive Learning as the Basis of the Testing Effect

Haopeng Chen, Jonas Simoens, Pieter Verbeke, Stefania Mattioni, Cristian Buc Calderon, Tom Verguts

One of the most robust findings in declarative memory is the testing effect, meaning that being tested enhances retention more than mere studying. However, the nature of the testing effect remains unclear. Yet, emergent theoretical frameworks propose predictive learning as a potential cognitive basis for this phenomenon. Predictive learning is a fundamental principle for learning in neural networks. It posits that learning occurs based on the difference (or error) between prediction and feedback (i.e., prediction error). We propose that in testing scenarios, as opposed to mere studying, participants predict potential answers, and the error between this prediction and subsequent feedback gives rise to a prediction error. To investigate this assumption, we developed a novel experimental design, where human participants engaged in testing or studying Dutch-Swahili word pairs and subsequently passed a memory recognition test. Our results revealed a testing effect across two behavioral experiments with this paradigm. Crucially, subsequent modelling suggests that only neural networks incorporating predictive learning can effectively account for the breadth of data associated with the testing effect. Finally, we carried out the same tasks using fMRI to explore the neural basis of the testing effect. We will describe the behavioral, modelling, and neural results, as well as their implications for declarative memory.

Location: Cafeteria
Poster 53

Biased sampling and persisting inaccurate negative impressions

Emily Vanlooy, Chris Harris, Irene Van de Vijver, Joke Baas, Ruud Custers

In a recent study, we investigated how reinforcement learning might perpetuate biased impressions through selective outcome feedback and endogenous sampling. Participants executed a two-armed bandit task with two identical options, where initial evidence led them to perceive one option as superior. We hypothesized that frequent reinforcement would sustain this bias, fostering the notion that the oft-chosen option was more beneficial. In contrast, infrequent reinforcement was expected to encourage exploration and correction of the bias. The study was conducted entirely online and comprised two experiments: (i) a reward-based experiment ($n = 300$) where financial gains served as a reinforcer, and (ii) an aversive experiment ($n = 301$) where choices were reinforced through the omission of an anticipated financial loss. In both experiments, participants were randomly assigned to either a frequent or infrequent reinforcement condition. Notably, while the expected results were not observed in a rewarding context, participants in the aversive setting did demonstrate the expected bias when anticipated losses were frequently omitted. These results highlight how irrational aversive beliefs might be inadvertently reinforced through an interaction between expectations and choice behavior, underscoring the importance of safety behaviors in ambiguous contexts as a mechanism underlying the persistence of disproportionate fear and avoidance. In a next study, we intend to replicate these results in the lab using a loud noise as US and including skin conductance measures, in order to investigate whether and how this mechanism may lead to unwarranted fear and avoidance. (Preliminary) results of this research may also be presented.

Location: Cafeteria
Poster 54

Neurophysiological correlates of near-wins in gambling: A systematic literature review

Miguel Peixoto, Artemisa Dores, António Marques, Fernando Barbosa

Introduction: Gambling disorder is a behavioral addiction, with personality, game type, dysfunctional cognitions, and near-win (NW) effect playing a key-role. Electroencephalography (EEG) has been one of the methods used to assess brain activity and its responses, through event-related potentials (ERP). The aim of this study is to systematically review the data published on ERP elicited by gambling paradigms.

Methods: The review followed the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols (PRISMA).

Results: A total of 15 studies were included, 12 with non-problematic gamblers and three with problematic gamblers (PGs). The P300 results show that wins lead to higher amplitudes compared to other outcomes. Comparing losses with NWs reveals heterogeneous results, with NWs before the payline having a higher P300 than losses. The FRN results show that losses lead to a more negative amplitude compared to wins. Comparisons between losses and NWs also reveal heterogeneous results, but NWs before the payline have a more positive FRN amplitude than losses, and similar to wins.

Conclusion: The current review highlights the heterogeneity of results regarding brain responses to NWs, especially when it comes to differentiating it from losses, for both P300 and FRN. Differences in methodology could potentially justify the varying results. Furthermore, the scarce studies involving PGs does not allow to determine specific patterns of brain responses in this group. Given these findings, it is important to implement further studies with well-characterized samples and multidomain assessment protocols, supported by theoretical models of addiction.

Location: Cafeteria
Poster 55

Exploring cerebellar lateralization in mentalizing: a transcranial magnetic stimulation study

Sonia Paternò, Andrea Ciricugno, Zaira Cattaneo, Chiara Ferrari

Historically, the cerebellum was known to have a role in motor coordination and planning; however, recent studies demonstrated its involvement also in cognition and social cognition. Neuroimaging, neuropsychological and neuromodulation studies converged in pointing specifically to the cerebellar hemispheres in supporting these higher-order processes. There is also increasing evidence that the bilateral cerebellar hemispheres are asymmetric in function; for instance, language is heavily right-lateralized, and spatial functions are left-lateralized, reflecting crossed cerebro-cerebellar projections. However, little is known about the pattern of cerebellar hemispheric functional asymmetries in the domain of social cognition, and existing evidence is mixed, with some investigations reporting a stronger contribution of the right (vs. left) cerebellar hemisphere, and others the reverse pattern. In the present study, we explored the lateralization of the cerebellar hemispheres in mentalizing processes using transcranial magnetic stimulation (TMS). Participants were asked to perform affective and cognitive mentalizing tasks and a control task (to exclude non-specific effects of the stimulation) while TMS was applied over the right cerebellar hemisphere, the left cerebellar hemisphere, and the vertex (control condition). Preliminary results confirm the cerebellum's role in mentalizing, possibly suggesting a stronger contribution of the right (vs. left) cerebellar hemisphere. Our findings point to right lateralization of the cerebellum in mentalizing processes and offer new insights into functional brain asymmetry.

Location: Cafeteria
Poster 56

The Effects of Transcranial Alternating Current Stimulation on Athlete Performance and Associated-Brain Oscillations: Preliminary Results of individualized and sport-specific approach

Tuba Aktürk, Elif Bingöl, Burcu Bölükbaş, Harun Yırıkoğulları, Esra Dalmızrak, Esra Ünsal, Sümeyye Özdemir, Alexander T. Sack, Bahar Güntekin

Transcranial Alternating Current Stimulation (tACS) has emerged as a prominent method for neuromodulating oscillatory brain activity and associated functions. Despite several studies demonstrating promising after-effects of tACS on athlete performance, a substantial body of research has yielded inconclusive results, indicating a lack of consistency and robustness regarding such potential lasting effects. This study aimed to explore the impact of alpha tACS on athlete performance and associated brain oscillations using an EEG-based individualized approach to optimize efficacy and reduce variability. Twenty-two athletes meeting inclusion criteria participated, divided into three groups: individualized alpha frequency (IAF) tACS(N=9), 10 Hz tACS(N=4), and sham tACS(N=9). Individualization of tACS frequencies was based on pre-EEG measurements conducted for each participant, followed by a 20-minute administration of 2 mA tACS over the bilateral supplementary motor area during resting-state. Comprehensive performance tests (balance, reactions, and jump tests) and EEG recordings were conducted both before and after the tACS interventions. The results revealed an increase in resting-state alpha power over motor areas in the IAF group after tACS ($p<0.05$), while no such significant changes in the oscillatory alpha power were observed in the 10 Hz and sham tACS groups. Additionally, several performance scores across all domains improved significantly only in the IAF group ($ps<0.05$), with no statistically significant effects observed for the other stimulation conditions. This study highlights the selective after-effects of individualized alpha frequency tACS on both, oscillatory alpha power and behavior in modulating athlete performance.

This study was funded by Turkish National Science and Research Council (No. 121E669).

Location: Cafeteria

Poster 57

Smells Nice, But Only To Me: Comparing the Predictive Value of Individual Perception and Molecular Structure on Cortical Hemodynamic Activity

Tim Jesgarzewsky, Antonie Bierling, Ilona Croy

Recent advances in machine learning have improved our ability to predict olfactory perceptions based on the molecular structure of odorants. Computational models can now use physicochemical information of volatile molecules to predict their perceptual properties on a group level. However, olfaction is inherently subjective. Individuals may perceive the same odorant differently for many reasons, for example, different prior experiences with the same odorant. This study aims to examine this apparent contradiction by investigating the neural underpinnings of olfactory perception at the cortical level. Using odorants with known molecular structures, we want to examine the interplay between molecular information and individual perceptual experiences in the olfactory system.

Building on a previous study with over one thousand participants, we selected six monomolecular odorants spanning a wide range of perceived pleasantness, disgust, irritability, and familiarity. Those six odors were each presented sixteen times to sixty participants via an olfactometer while we recorded hemodynamic responses in the prefrontal cortex with functional Near-Infrared Spectroscopy. Participants furthermore rated the perceived pleasantness, disgust, irritability, familiarity, intensity, edibility, warmth, and coldness of each odor.

We present the first results of this study, showing cortical activity in response to each of the monomolecular odors and relating the cortical activity to the individual ratings of the participants.

Thereby, this study will clarify whether olfactory processing is better explained by chemical molecular characteristics of volatile molecules or by individual olfactory experiences.

Location: Cafeteria
Poster 58

Grief as a process of cognitive reorientation and disruption of prospective memories

Barry Karlsson, Andreas Frick

Grief is commonly viewed as an emotional response to loss. This profound subjective experience is often characterised by feelings and manifestations of sadness, anger, relief, guilt, and emptiness. Common complications associated with grief include yearning for the deceased and experiencing traumatic symptoms caused by the loss. In about 10-20% of cases, there are persistent reactions known as complicated grief, and in the more severe chronic cases, known as prolonged grief disorder, which occurs in 1-10% of cases.

Unexpected, sudden losses can have a profound impact on individual's life, affecting plans and expectations for the future. Hence, grief interacts with future planning, predictive expectations, and prospective memory, which potentially influencing the grief process. However, the role of updating prospective memories and plans in facilitating a successful grief process is not well understood.

We aim to conduct a literature review to explore the relationship between experiences of loss and prospective memory, and how updating of prospective memory interacts with the grief process. It will test the hypothesis that grief is a complex response that involving memory updating, the reorientation of prospective memory, and the adjustment of future planning. PubMed, PsycINFO, Scopus, and Web of Science will be searched for articles covering grief, loss, bereavement, prospective memory, and prediction error.

The study will inform theory of grief and elucidate the role of prospective memory and memory updating in the grief process. It may also inform clinically relevant distinctions between adaptive and maladaptive responses to loss.

Location: Cafeteria
Poster 59

Effects of stimulus size on the perception of genuine and artificial facial expressions

Annika Ziereis, Anne Schacht

Seeing an angry individual in close physical proximity can not only result in a larger retinal representation of that individual and an enhanced resolution of emotional cues, but may also increase motivation for rapid visual processing and action preparation. The present study investigated the effects of stimulus size and emotional expression on the perception of happy, angry, non-expressive, and scrambled faces. We analyzed event-related potentials (ERPs) and behavioral responses of N = 40 participants who performed a naturalness classification task on real and artificially created facial expressions. While the emotion-related effects on accuracy for recognizing authentic expressions were modulated by stimulus size, ERPs showed only additive effects of stimulus size and emotional expression, with no significant interaction with size. This contrasts with previous research on emotional scenes and words. Effects of size were present in all included ERPs, whereas emotional expressions affected the N170, EPN, and LPC, irrespective of size. These results imply that the decoding of emotional valence in faces can occur even for small stimuli. Supra-additive effects in faces may necessitate larger size ranges or dynamic stimuli that increase arousal.

Location: Cafeteria
Poster 60

A cognitive-linguistic investigation of the concept and skill of innovation

Lourenço MD Amador

Innovation has been essential to human progress and the development of the 21st Century world. Thus it has become a major buzzword in modern times, both in our daily lives and in research. It started gaining momentum as a topic of research outside of economics and management in the 1970s, leading to the emerging field of “Innovation Studies”. However, despite this popularity, interdisciplinary conceptualizations and models of innovation and its skills have not been properly investigated. Furthermore, the relationship with other related concepts (e.g. creativity) has also not been clearly mapped out. Therefore, this research sought to address these gaps via answering two main questions: “What is innovation?” and “Is innovation a skill?”. The approaches used were multidisciplinary literature reviews, to understand how different perspectives conceptualize innovation and its skill; a Prototype Analysis, to investigate the layperson’s conceptualization of innovation, a perspective lacking from the literature; and a pilot study with a methodology inspired by grounded theory, to investigate and produce expert-filtered definitions and models of innovation and the skill of innovation. From these theoretical and experimental approaches, the definitions of innovation and its skills, developed from these findings are:

Innovation is a creation or alteration of a tool or knowledge, which has significant influence on its relevant domain(s) or system(s), by one or more agents, either intentionally or attentionally. It can be discovered through luck, exploration or iterative development. The agent involved with innovation is visionary and capable of high-level ideation and knowledge implementation towards solving difficult problems.

Location: Cafeteria
Poster 61

Electrophysiological underpinnings of the cognitive map within egocentric and allocentric reference frames

Freda Ménétré, Nicolas Piron, Roland Maurer, Virginie Descloux, Nicolas Burra

Egocentric (self-referenced) and allocentric (object-referenced) spatial processing within the context of cognitive mapping have different neural underpinnings. While diverse neural foundations for these reference frames are acknowledged, their specific cognitive and electrophysiological characteristics remain under-explored. To investigate these specificities, we enrolled 50 healthy adults aged 18-35 years, who were submitted to a computerized task built upon a modified version of the Cognitive Map Recall Test (CMRT). The test employed a curated set of Geneva (Switzerland) landmarks, meticulously selected during a preceding in-house study. This task required participants to evaluate spatial proximity between landmarks, alternating between egocentric and allocentric perspectives. We recorded behavioral metrics (accuracy, reaction times) alongside electroencephalographic (EEG) data. Surprisingly, no significant disparities surfaced in terms of reaction times between the two reference frame conditions. However, egocentric trials exhibited higher accuracy compared to their allocentric counterparts. This phenomenon alludes to a potential cognitive advantage or preference for egocentric spatial processing in the given experimental context. Currently, the study is in an advanced analytical phase, focusing on dissecting event-related potentials (ERP) and time-frequency oscillations, mainly in the alpha and theta bands, from the EEG data. These analyses are crucial for understanding the neural dynamics associated with the task. Ultimately, this research contributes to our evolving understanding of the interplay between reference frames and cognitive mapping processes. Understanding these distinctions not only enhances our theoretical knowledge but also has practical implications in areas such as navigation strategy development and neurological rehabilitation.

Location: Cafeteria
Poster 62

The sense of agency affects the expenditure of pro-active cognitive control during the cue-target interval of a color-discrimination task

Stefan Arnau, Nathalie Liegel, Edmund Wascher, Daniel Schneider

Cognitive performance substantially depends on task engagement. The degree of this, however, is adjusted to the expected benefit of successful task-performance. For a benefit being obtainable reliably, the outcome of an action needs to be controllable. Consequently, the sense of agency is crucial regarding the motivated expenditure of cognitive control. The present study investigates effects of reduced agency on task-engagement. 39 participants participated in an EEG study deploying a two-alternative forced choice color-discrimination task. The difficulty of each trial varied on a trial-to-trial basis and was cued before target onset. To manipulate the sense of agency, the subjective reliability of the response detection was manipulated in a block wise manner. For 3 experimental blocks, the feedback regarding the response always corresponded to the response that was given. For the other 3 experimental blocks the feedback regarding the given response was flipped in 30% of the trials. Performance significantly decreased in the flip-blocks compared to blocks with response-consistent feedback. The analysis of the EEG focused on the cue-target interval, as pro-active cognitive control has been shown to be affected by motivation. Here, a reduced agency is reflected by a diminished CNV amplitude as well as by a less pronounced alpha-desynchronization during the cue-target interval. These results indicate that a reduced controllability of the outcome of an action led to a decreased sense of agency and decreased motivation. The EEG results suggests that the resulting performance decrement is a consequence of a reduction of pro-active top-down cognitive control during the cue-target interval.

Location: Cafeteria
Poster 63

Investigating Boundaries in Urban Mental Mapping - A Case Study in Spatial Cognition

Dora Hegyesi, Borbala Jasz

The first phase of this research aims to explore the differences in mental mapping among residents of Budapest. The study focuses on examining the mental maps of 15-year-old high school students from Budapest, with data collected in bilingual format. Following a background survey, students complete the Santa Barbara Sense of Direction Scale (SBSDS). Subsequently, they are tasked with drawing their route from home to school, numbering the elements on the map in the order of their drawing. Furthermore, students are required to describe this route in writing, limiting their description to 200 words. As a final task, students are prompted to create a mental image of Budapest by drawing a map that includes 15-20 personally important or symbolic landmarks in the city.

Data collection in Budapest took place during the autumn of 2023, with 48 students completing all parts of the survey. In the quantitative analysis, the connections between SBSDS results, the background survey, and the Budapest mental maps were interpreted. Due to the non-normal distribution of the dataset, non-parametric tests were conducted. A Spearman's Rho test revealed a significant correlation ($p=0.20$) between SBSDS results and the accuracy of the mental maps' geographical orientation. Additionally, a Kruskal-Wallis test indicated a potential correlation ($p=0.76$) between means of travel in the city and the number of elements on one's mental map of the city.

In our presentation, we will discuss the methodology, outline the steps, and present the expected data along with partial results from the first phase of the research.

Location: Cafeteria
Poster 64

Learning to adapt learning rate to multiple environments

Jonas Simoens, Senne Braem, Stefania Mattioni, Mengqiao Chai, Nicolas Schuck, Tom Verguts

People often have to switch back and forth between different environments that are characterized by different statistics. While some environments require fast learning (i.e., high learning rates), other environments require lower learning rates. Previous studies have shown that people adapt their learning rates to their environment when differences in environment statistics are clustered in time. However, such differences in learning rates could reflect emergent properties of participants' (non-environment-specific) responses to locally experienced prediction errors. As such, it remains unclear whether people can learn environment-specific learning rates, and instantaneously retrieve those learning rates when revisiting environments (i.e., meta-learn). To address this, in the present study, 50 participants performed a continuous estimation task in eight-trial blocks on six locations around an island (visiting each location 20 times), with optimal learning rate depending on location. Crucially, this task allowed us to estimate learning rates on a trial-by-trial basis, which in turn allowed us to test whether differences in learning rates between locations were already present in the first trial of each block. This was indeed the case in the second half of the task, which indicates that participants learned to associate appropriate learning rates to different locations. To investigate the neural underpinnings of these environment-learning rate associations, we also collected fMRI data while participants performed this task. Using representational similarity analyses, we investigate whether people's neural voxel patterns are sensitive to the environment-specific learning rates (when arriving at new island locations). These analyses will be the main focus of the poster.

Location: Cafeteria
Poster 65

The Art of Brainwaves: A Survey on Event-Related Potential Visualization Practices

Vladimir Mikheev, Rene Skukies, Benedikt Ehinger

The field of M/EEG research has witnessed significant advances, such as the integration of virtual reality and the emergence of mobile EEG setups. Virtual reality setups provide more naturalistic environments, and mobile EEG systems enable data collection in real-world settings. However, this paradigm shift adds new levels of complexity to the analysis and visualization of EEG data: increase of data dimensionality and quasi-experimental complex statistical models. Both make understanding the data and visualizing it much more complicated.

This study explores the user experience of a typical EEG practitioner attempting to visualize ERPs. We conducted an online survey of approximately 200 respondents, including both novices and experts in the field of EEG. The results shed light on the most used tools for ERP visualization, preferred tool features, most common visualization challenges, and awareness of issues related to color and error bars in graphs.

Our survey indicates that tools such as EEGLAB, FieldTrip, and ERPLAB were best known, along with MNE. We found that several common problems were faced by practitioners during ERP visualizations: adding uncertainty to ERP plots, styling and color in butterfly plots, channel highlighting in topoplots were among the common challenges. Researchers valued features such as publishable plots, reproducibility, and speed, and were skeptical of interactive data selection. Many were unaware of color map issues, and 40% omitted error bars in published ERP plots. The findings of this study provide valuable guidance for the development of effective visualization tools (especially for Mobile EEG) and improved research practices.

Location: Cafeteria

Poster 66

Oscillatory Responses of Object Based Number Perception

Furkan Erdal, Bahar Güntekin

As it was proposed, within our number perception processes, subitizing refers to our immediate and precise recognition of a small number of items, typically up to 3-4 objects. Conversely, the approximate number system comes into play when we encounter 5 or more objects, where we estimate their quantity. In recent years, electrophysiological underpinnings of these mechanisms were investigated but few studies focused on the Event-Related Oscillations. In this study, we examined Event-Related Oscillatory responses of participants ($N = 30$) to visual stimuli containing a different number of dot objects from 0 to 9. The dots appeared randomly and remained on the screen for about 10 ms. The stimuli were displayed 400 times (40 times for each type), between pre- and post-exposure to gaussian-noise masks. When we examined the EEG responses with montecarlo/permutation analysis, it was seen that number perception is related to event-related phase coherences. Also, it has been observed that the phase coherence responses to 3 or fewer objects differ from the responses to 4 or more objects. Our results show that the upper limit of our number system, in which we perceive object numbers directly, is 3 objects, and the lower limit of our number system, in which we indirectly perceive object numbers by estimating, is 4 objects. Lastly, it has been claimed that the theory of the construction of mathematical objects lies at the basis of this dissociated number system, and the consistencies of this theory and the results of our study have been demonstrated.

Location: Cafeteria
Poster 67

Systemic neurophysiological entrainment to task-related rhythmic auditory stimuli

Vanesa Muñoz Burbano, Carlos M. Gómez, Manuel Muñoz-Caracuel, Francisco J. Ruiz-Martínez,

While physiological oscillations within our bodies display inherent and spontaneous rhythmicity across diverse timescales, adaptive behavior to environmental demands emerges from the intricate interplay among these bodily rhythms. In this study, we investigated the underlying oscillatory dynamics of various bodily rhythms in response to regularly presented auditory stimuli, whether processed passively or actively. The results revealed that actively engaging with rhythmic auditory stimuli led to systemic entrainment across a spectrum of central nervous system (CNS) and autonomic nervous system (ANS) physiological rhythms, while no entrainment effect to external auditory inputs was observed during passive listening. Moreover, distinct phases of physiological oscillations were prioritized upon the onset of auditory stimuli or motor responses, correlating with reaction times and indicating a possible manifestation of embodied facilitation for heightened cognitive control. These findings suggest that the intricate interplay of brain-body rhythms with external sensory inputs plays a significant role in optimizing temporal sensory coding and sensorimotor behavior.

Location: Cafeteria
Poster 68

Optimal Processing of Surface Facial Electromyography to Identify Emotional Expressions: A Data-Driven Approach

Joanna Rutkowska, Tommaso Ghilardi, Stefania Vacaru, Johanna van Schaik, Marlene Meyer, Sabine Hunnius, Robert Oostenveld

Surface facial electromyography (EMG) is a commonly used tool to detect emotions from subtle facial expressions in studying emotional cognition and mimicry. However, there is little agreement concerning the optimal way to process the EMG signal, such that the study-unrelated variability (noise) is removed while the emotion-related variability is best retained. The aim of the current project was to identify an optimal processing pipeline for detecting emotional expressions with facial EMG data. Using a multiverse approach, we systematically varied the processing steps that we identified in existing literature to create 72 processing pipelines representing all different processing choices. We applied these pipelines to a previously published dataset from a facial mimicry experiment, in which 100 adult participants observed happy and sad facial expressions while the activity of two of their facial muscles, zygomaticus major and corrugator supercilii, was recorded with EMG. We employed a resampling approach and subsets of the original data to investigate the effect and robustness of different processing choices on the performance of a model that predicted the mimicked emotion (happy/sad) from the processed data. In addition, we used a Random Forest model to find the most impactful processing steps: baseline correction, standardisation within muscles, and standardisation within subjects. The feature of interest and the signal averaging had little influence on the sensitivity of the prediction of the model. Based on our findings, we recommend an optimal processing pipeline, providing guidelines for future research and enabling the researchers to re-process and re-analyse existing datasets.

Location: Cafeteria
Poster 69

Rapid Brain Responses to Emotional Contexts Mediate the Effect of Motivational Intensity on Emotion Regulation Choices.

Xinyu Yan, Jiajin Yuan, Jiemin Yang

Motivation plays a unique role in emotion regulation, particularly in the choice of emotion regulation strategies (ER choice). Our previous study revealed that increased motivation led to a preference for distraction over reappraisal due to the narrowed attention, yet neural underpinnings supporting this phenomenon remain unclear. Here, we employed event-related potentials (ERPs) to determine whether motivation influences ER choice by early attention processing (P2) or late resource engagement (LPP). EEG activities were recorded for the pictorial contexts varying in motivational intensity (high vs. low) and direction (approach vs. withdrawal), while participants (N=68) were required to decide which strategy from the two options they would use to regulate their emotions. Behavioral results replicated prior findings, showing a preference for distraction over reappraisal in high-withdrawal motivated contexts, while the opposite pattern appeared in low-withdrawal motivated contexts. Unexpectedly, this effect vanished in high- versus low-approach motivated contexts. Moreover, enhanced P2 and posterior LPP were captured in high-intensity motivated emotional contexts, irrespective of motivational direction. However, it's noteworthy that only the frontal P2 (170-220ms) and early LPP (300-500ms) are associated with the subsequent ER choice, and mediate the impact of motivational intensity on ER choice. These findings suggest that heightened motivation drives individuals to favor distraction over reappraisal in emotion regulation due to the more occupation of attentional resources. They also shed light on utilizing an individual's neural physiological responses to suggest appropriate emotional regulation strategies.

Location: Cafeteria
Poster 70

Foreign junior female medical students: adding context amplifies between-participant differences in emotional experience

Caterina Vannucci, Luca Cecchetti, Stephanie Burnett Heyes, Giada Lettieri, Giacomo Handjaras, Emily Holmes

Introduction: To construct emotional states, humans encode stimuli together with the context they are embedded in. Yet, little is known about how context influences emotion elicitation. To fill this gap, we exploited a paradigm from mental imagery research, which uses picture-word cues (PWC) and modulates contextual information from the same image.

Aim: To study the role of context in core affect using PWC.

Methods: We built 1381 PWC from 320 images and had Italian (N=1934, F=991) and English (N=403, F=201) participants rate their valence and arousal. In a cross-linguistic analysis, we asked:

- Is core affect modulated by context?
- Does context mediate between-subject variability?
- Does picture valence play a role?

Results: Context modulates valence in both datasets (80% 'picture vs PWC' tests $p < .05$) more than arousal (less than 30%). Cross-linguistic accordance between ratings is also stronger for valence (90% large eta-squared; $r = .7$, $p < .001$) than for arousal (25% moderate eta-squared; $r = .15$, $p = .006$).

In 80% of $p < .05$ valence comparisons, between-subjects variability of PWC ratings is larger than picture ratings, representing a case of context ambiguation. In the remaining 20%, context polarizes images by reducing dispersion and PWC are more likely to follow the valence of original images (chi-squared=10, $p = .001$).

Conclusions: Context influences emotion elicitation, but in a counterintuitive way in both Italian and English samples. By adding meaning, it leads to a larger between-subject variability and an overall ambiguation of stimuli. Instead, when polarized, PWC predominantly retain valence of original images.

Location: Cafeteria
Poster 71

Skin-based interoception and emotion: Affective touch and thermosensory accuracy are linked to depression and anxiety symptomatology

Laura Crucianelli

Interoception is related to the generation of bodily feelings and to the awareness of ourselves as ‘sentient beings’, informing the organism about its bodily needs. Interoception is crucial for our survival but also for the experience of emotions and mental health. For example, alignments of interoceptive dimensions (i.e., accuracy, sensibility, awareness) can predict emotional symptoms, such as anxiety. Here, we aimed to investigate the relationship between the perception of skin-mediated interoceptive signals (i.e., thermosensation and affective touch) and self-reported depression, anxiety, and stress. Across two studies, participants completed the Depression Anxiety Stress Scale (DASS-21) and a dynamic thermal matching task and static temperature detection task (N = 172) and an affective touch task (N = 123), as well as the heartbeat counting task. We found that higher self-reported anxiety and depression scores were related to a lower perception of dynamic temperature on the hairy skin of the body only. Discrepancies between thermal accuracy and sensibility measures (‘trait prediction error’) were related to heightened anxiety. In the affective touch task, higher cardiac accuracy and self-reported depression were related to a better fit of the quadratic model describing the relationship between velocities of touch and pleasantness and the steepness of the curve, respectively. Thus, although the perception of temperature and tactile pleasantness follows a consistent pattern at the group level, individual differences in interoceptive abilities and self-reported depression and anxiety do play a role. Taken together, skin-mediated signals can offer novel insights into the link between interoception, emotions, and mental health.

Location: Cafeteria
Poster 72

Brain oscillations in joint action: Insights from MEG hyperscanning

Juan Camilo Avendano Diaz, Riitta Hari, Lauri Parkkonen

We investigated the neural and behavioral signatures underlying action observation, audience effects, leader–follower coordination and joint improvisation in interacting dyads. We present data from 10 pairs of participants performing a 1D finger-movement mirror game while magnetoencephalography (MEG) was simultaneously recorded from both subjects and the related finger kinematics was tracked using accelerometers. We observed that alpha-band source-level power in widespread brain regions were reduced in social (interaction or observed action) compared to individual (isolated) action. This reduction in alpha was restricted to occipital areas when contrasting interaction vs. observed action. We also obtained a widespread beta suppression in interaction compared to individual action (observed or in isolation), and a left TPJ suppression when comparing observed vs. Isolated action. Across interactive conditions, we found that rolandic theta and superior parietal beta were stronger in followers than leaders, while occipital beta was stronger in leaders than in joint improvisers. When examining intra-brain functional connectivity, we observed a reduction in the alpha-band-mediated connectivity (weighted phase lag index) while interacting, compared to individual (isolated) action. This reduction involved occipital, temporal, parietal and frontal brain regions. Multivariate classification on the source-level mean power of the two-brain data (1000-ms moving windows with 500-ms overlap; recursive feature elimination with a logistic regression classifier, 10-fold CV, 20% held-out) revealed a set of brain regions and frequency bands whose signals enabled 67–99% accuracy in classifying leader–follower interaction vs. synchronous movement. Our results contribute to the understanding of the role of brain oscillations on interpersonal motor interactions.

Location: Cafeteria
Poster 73

Cautiousness in approach-avoidance conflict is linked to compulsivity but not self-reported anxiety

Juliana Sporrer, Dominik Bach, Filip Melinscak

Approach-avoidance conflict (AAC) tasks are a mainstay of pre-clinical anxiety disorder research, due to the impact of anxiolytic drugs on cautious behaviour within these tests. While cautiousness appears to be a stable behavioural trait, growing evidence suggests that it is unrelated to self-reported anxiety. Here, we ask what other clinically relevant personality traits determine AAC decisions, using an exploration-confirmation approach across two large online samples (N1 = 315; N2 = 690). Participants chose whether, and how rapidly, to approach a reward under risk of a virtual predator with varying threat probability and magnitude. They also completed a comprehensive psychiatric questionnaire battery with a known three-factor structure, namely Compulsive Behaviour and Intrusive Thought (CIT), Anxious-Depression (AD), and Social-Withdrawal (SW). Results showed CIT was the main predictor of all behavioural readouts. Higher CIT scores predicted decreased passive avoidance, heightened behavioural inhibition (i.e. later approach), and reduced sensitivity to threat features. We also found that high CIT implied an enhanced belief in threat-reward correlations, which could explain increased behavioural inhibition. This suggests an altered or simplified model of threat and reward processing in these individuals. Additionally, individual questionnaire scores revealed non-specific relationships, underscoring the value of transdiagnostic dimensions over traditional phenotyping. Crucially, no associations were found for AD or gender. In conclusion, this study highlights that cautiousness in AAC tasks is linked to a compulsivity symptom dimension, but not to self-reported anxiety. This finding challenges the traditional understanding of AAC tasks in anxiety research and underscores the importance of considering broader psychopathological factors.

Location: Cafeteria
Poster 74

Sensitivity to Basic Emotional Expressions and the Emotion Perception Space in the Absence of Facial Mimicry

Arianna Schiano Lomoriello, Giulio Caperna, Pier Francesco Ferrari, Paola Sessa

According to sensorimotor simulation models, recognition of another person's emotion is achieved by recreating the motor production of the perceived facial expression in oneself. Therefore, congenital difficulties in the production of facial expressions may affect emotion processing. The present study assessed a sample (N = 11) of Moebius syndrome (MBS) patients and a matched control group (N = 33), using a highly sensitive emotion recognition task. Leveraging the uniqueness of MBS, which is characterized by congenital facial paralysis, the role of facial mimicry and sensorimotor simulation in creating precise embodied concepts of emotion categories was investigated. Particularly, the research focused on how MBS patients (both as a group and individually, compared to controls) perceived the intensity of primary emotions and how well they discriminated between these and secondary (i.e., blended) emotions. The results showed that MBS patients registered significantly lower intensities for sadness, fear, anger, and disgust. Furthermore, these emotions appeared closely clustered—and therefore confused with anger and surprise—in the multidimensional scaling map, which was used to qualitatively analyze the emotion perception space. Further analysis of each MBS participant showed a stronger tendency in most patients to perceive primary emotions as less intense, relative to controls. Thus, the findings provide evidence for a residual deficit in emotion processing in adults with MBS.

Location: Cafeteria
Poster 75

Investigating the Mechanisms Behind Music-Induced Analgesia: An Effect of Affective or Cognitive Modulation?

Nazli Bronz Arican

Music- and distraction-induced pain reduction have been investigated extensively, yet whether the analgesic effect of music is mediated by induction of a relaxed affective state or diversion of attention from own suffering remains unknown. In the present study, we used the cold pressor task to compare the pain tolerances of participants in four groups: a music group that listened to a classical music piece in the absence of any explicit tasks, a music-and-attention-to-music group that listened to the same piece while also rating the arousal levels in the music piece every five seconds, a music-and-attention-to-pain group that rated their own pain levels every five seconds while listening to the same piece, and a silence group as control. At the group level, we did not find a pain tolerance difference between the music and silence conditions. However, there was a strong positive correlation between how relaxing the music was rated by the participants and their pain tolerances in the music condition. Pain tolerances in the music-and-attention-to-music condition were greater than those in the music and silence conditions. Contrary to our predictions, pain tolerances in the music-and-attention-to-pain condition were also greater than those in the silence and music conditions and not different than those in the music-and-attention-to-music condition. These findings indicate that a relatively small analgesic effect of music might be mediated by how relaxing people find a specific music piece; and attentional engagement, even if it is towards one's own suffering, might be sufficient to induce a relatively larger analgesic effect.

Location: Cafeteria
Poster 76

Object ownership processing in peripersonal space

Lucie Lenglar, Clemence Roger, Adriana Sampaio, Yann Coello

Peripersonal space (PPS), as opposed to extrapersonal space (EPS), represents a motor interface between the body and the environment. However, objects in peripersonal space (PPS) have different affective values depending on whether they belong to oneself or to others (object ownership), which should interfere with objects motor encoding. In this study, we analysed the accuracy of reachability judgments of self-owned and other-owned objects presented in PPS or EPS. EMG activity was recorded on the right thumbs (flexor pollicis brevis) to detect correct and erroneous motor activations. Behavioural data showed that reachability judgments were faster for self-owned objects in PPS and for other-owned objects in EPS. 10% of trials showed initial response errors, which were higher in the PPS for other-owned objects and in the EPS for self-owned objects. 82% of these errors were corrected and corrections were more efficient for self-owned objects in the PPS. Overall, the data revealed that reachability judgments were faster and more accurate in the PPS for self-owned objects, with more efficient regulation processes in the presence of motor errors. Motor selection and correction are thus modulated by the affective context of object ownership, in relation to the specific role of the PPS in encoding self-relevant objects for action.

Location: Cafeteria
Poster 77

Exploring the Effects of Incarceration on Social Behavior: A Longitudinal Study on Current and Former Prisoners.

Victoria Rambaud, Ilke Veeckman, Louis Favril, Tom Vander Beken, Emilie Caspar

Background: Prisons represent a unique social environment characterized by bullying, violence and reduced social interactions. Ample studies highlighted that incarceration has negative psychological and social effects on inmates, both in the short and long terms. Research is moving from a “criminal” brain to a “prison” brain perspective, showing that prison negatively impacts several cognitive processes, especially regarding recidivism. Aim: This project investigates the relationship between imprisonment and social behaviors in an interdisciplinary neuro-criminological study, in which the effect of prison on pro- and anti-social behaviors is assessed. Methods: Both newly detained and newly released prisoners are followed for one year, at 4 different timepoints, to study the impact of the first year of incarceration and the first year after being released from prison. We will evaluate social decision-making, reward and punishment processing, and emotion recognition using cognitive tasks. Preliminary Data: At baseline, both newly-detained inmates and inmates about to be released show a strong ingroup bias as they tend to be more prosocial with other (former) detainees and antisocial with outgroups, i.e. individuals who have never been incarcerated. However, newly-detained inmates seem to show a stronger bias as they tend to make more anti-social decisions towards outgroups than inmates who are about to be release.

Location: Cafeteria
Poster 78

Supramodal representation of emotion expressions across the face and voice networks

Stefania Mattioni

Successful social interactions rely on efficient discrimination of emotion expressions from facial and vocal signals. A comprehensive characterization of brain regions in face and voice networks engaging in unimodal and crossmodal emotion expression representation remains unresolved. Brain activity was measured in individuals presented with dynamic facial and vocal expressions across five emotional categories. Relying on functional localizers, we localized eight face preferential (bil-FFA, bil-OFA, bil-pSTS, and bil-PCG) and four voice preferential brain regions (bil-TVA and bil-PCG) in each participant. Data analysis in these individually defined areas, through multivariate pattern classification analyses, revealed that facial and vocal emotion categories could be decoded in all regions of the face and voice networks. Emotion expressions were decoded from the non-dominant crossmodal modality in all regions except the OFAs (vocal expressions in the face networks, and reversely). Significant decoding between bimodal stimuli and the dominant modality demonstrated multimodal input influence. Cross-modal decoding succeeded in visually defined bil-PCG and bil-pSTS and auditorily defined bil-PCG and bil-TVA, demonstrating a shared brain code between faces and voices in those regions. In conclusion, facial and vocal emotion expressions are prominently represented along face and voice preferential regions, both networks also representing information from their non-dominant modality. Additionally, the pSTS, the PCG, and the TVAs represent emotion expressions supramodally, through a code that is, at least partly, common between, hence independent of, the sensory modality of the input.

Location: Cafeteria
Poster 79

Ugh, what a huge and repulsive spider! The link between emotion regulation and spider size estimation

Yahel Dror Ben-Baruch

Fear can lead to perceptual biases. For example, people who are afraid of spiders perceive spiders as larger than people who are not afraid of spiders. In a series of studies, we have examined the link between this perceptual bias and emotion regulation, the physiological processes that subserve this link, and the role of expertise. Specifically, we conducted three experiments in which individuals were asked to rate the size of spiders, butterflies, and wasps depicted in pictures. Emotion regulation was either assessed via a questionnaire (Experiment 1) or manipulated (Experiment 2). Furthermore, pupillometry recordings were used to assess physiological activity (Experiment 2). Lastly, we conducted the experiment among spider experts (entomologists) to assess the role of expertise in size estimation (Experiment 3). Findings show that people with high fear of spiders perceive the spiders' size as larger than butterflies. This effect was not observed among the control group. We also observed a link between spider's size and suppression, a maladaptive emotion regulation strategy. Furthermore, preliminary findings from Experiment 2 indicate a role for physiological arousal in the link between emotion regulation and spiders' size estimation. Lastly, spider-experts did not show a perceptual bias, but an accurate perception of spiders' size. Overall, these findings suggest a link between fear and perceptual biases, which can be either increased or attenuated by different emotion regulation strategies, as well as expertise.

Location: Cafeteria
Poster 80

Feeling yourself when your self is altered, understanding interoceptive and affective touch alterations in schizophrenia

Paula Celeste Salamone

Presently, psychiatric conditions are diagnosed primarily by observing symptoms instead of biological mechanisms. Efforts in scientific research aim to transition towards a classification system rooted in mechanisms, a shift that holds the promise of enhancing patient care and treatment. There is a suggestion that individuals with schizophrenia (SZ) might experience changes in their interoceptive mechanisms and their ability to distinguish between self and others.

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 (with EEG) and questionnaires.

Preliminary results (questionnaires, behavioral and electrophysiological) show some alterations in self and interoception 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.

Location: Cafeteria
Poster 81

Brain mechanisms underlying self-projection toward running behaviors.

Roxane Philips

The seamless merging of action and perception is indispensable for navigating daily life and engaging efficiently with our surroundings. These action-perception couplings rely on a diverse set of cognitive functions (e.g. prospective thinking, navigation, mental imagery) that allow to adaptively unfold a new set of actions. It has been advanced that these cognitive abilities, often studied as distinct, signal for a common process of self-projection, whereas past experiences are used adaptively to imagine and enact actions allowing for meaningful individual-environment relationships. How self-projection mechanisms unfold when humans project themselves in the enactment of physical exercise, is still unclear. We examined this question by using functional brain imaging, a technique found to be sensitive for investigating neural basis of self-projection. We designed an experimental task that required participants to project themselves running or plogging (running while picking up litter) throughout a naturalistic trail. Participants were also asked to predict the level of physical effort they would feel across sub-sections of the trail. Using univariate and multivariate methods, we were able to identify the brain correlates triggered by participants' self-projection toward plogging and running, and to observe how these brain maps were modulated by predicted levels of physical effort. Additionally, psychophysiological interaction (PPI) analyses centered on the insula cortex (as a key region in the interoceptive-based neural networks underlying physical exercise) showed increased negative and positive PPI for the plogging condition, as compared to running condition. Altogether, these findings provide key insight on how the brain supports daily-life self-projection toward physical exercise.

Location: Cafeteria
Poster 82

Benefits of swaying in the standing position to improve performance in modified visual Stroop tasks

Cédric Bonnet

When individuals stand, they sway all the time and it is generally assumed that swaying should lower task performance compared to when being stable in the sitting position. On the contrary, we hypothesized that greater sway is associated with better task performance in performing a modified Stroop task. Twenty-four healthy, young adults performed an easier incongruent task and a harder reversed incongruent task in four body position conditions (standing against a vertical surface and standing freely with a wide, standard or narrow stance) without any external perturbation. Centre of pressure (COP) sway, head sway, eye movements, visual attention, and task performance were recorded. We found significant positive correlations between task performance and some COP and head sway variables after controlling for the level of attentional resources (partial correlations). Analyses of variance with three factors (body position, task difficulty, target distance) showed significant interaction effects between body position (and therefore postural sway) and the number of valid target findings. These significant interactions showed that narrow stance was the best body position for performing the incongruent task but also the worst body position for performing the reversed incongruent task. Overall, in usual quiet stance, healthy, young adults should use their postural sway, and not try to reduce them as much as possible, to explore their environment effectively to best reach the highest visual task performance. The question whether individuals perform desk-based jobs more efficiently when standing than when sitting could be asked, as long as physical fatigue is controlled.

Location: Cafeteria
Poster 83

Benefits of the standing position to improve performance in desk-based tasks

Cédrick Bonnet

Some previous studies reported a better Attention Network Task (ANT) performance in standing compared to sitting and some other studies showed that the complexity of body sway in fractal dimension could be associated with higher task performance in affordance tasks. However, so far, the relationship between body sway induced by standing or sitting and cognitive task performance remains unclear. Thus, we aimed to test relations between body sway and cognitive performance in standing and sitting position. In the literature reports, we are not aware of any such correlation analyses in any of these two body positions. Our assumption was to find positive significant correlations when standing but nothing significant when sitting, thus illustrating the benefits of adjusting postural sway to higher task performance. Seventeen young adults performed an ANT sequentially in standing and sitting positions. We measured head, neck and lower back displacements during the experiment. Our results showed that the complexity of body sway in fractal dimension positively correlated with the ANT performance and level of alertness in the standing position. In the sitting position, there was no significant correlation between body sway and ANT performance. These results suggest that the complexity of body sway while standing plays a positive role in visual task performance. The complexity of body sway in standing may increase alertness levels, potentially leading to better cognitive performance.

Location: Cafeteria

Poster 84

Touching while being touched: neural processing and behavioral measures of self-touch

Adam Enmalm, Trinh Nguyen, Rebecca Boehme

When people touch themselves they report perceiving a combination of the sensations from both the actively touching body part, and the passive, touched body part. However this sensation is not greater than only being touched by another person – the self-touch is attenuated. Self-touch has been studied using both functional magnetic resonance imaging and neurophysiological measurements, but these methods have significant limitations. Here we investigated the touching-touched interaction in self-touch using functional near-infrared spectroscopy (fNIRS). Participants were either touching their own forearm, touching an object, touching the experimenter's forearm, or had their forearm touched by the experimenter.

Data was collected in three regions of interest: temporal areas, somatomotor areas, and a temporoparietal cluster. These regions were chosen based on their involvement in self-touch, sensory attenuation, and bodily self-awareness. In the “touched” conditions, we partially replicated our earlier fMRI findings indicating a self-other difference in neural activity. This difference was not found in self-rated intensity. Regarding the “touching” aspect, we found that touching another person was perceived as more intense. Partial support for this was also found in the neural response. This study corroborated earlier studies on the social- and mechanistical components of why self-touch feels different. It also differentiates between often-neglected types of active touch: self-touch, touching another person, and touching an object.

Location: Cafeteria
Poster 85

Researching body perception: towards an integration of quantitative and qualitative approaches to address the multiplicity of bodily experiences

Marte Roel Lesur, Ana Tajadura Jimenez, Aleksander Valjamae, Laia Turmo Vidal, Jenny Slatman

In this perspective, we propose that qualitative methods from design research addressing participants' accounts, together with quantitative tools from cognitive neuroscience, might pragmatically contribute to a richer understanding of one's body experience. Established methods from cognitive neuroscience aspire to create a cumulative and reproducible science of one's body experience, however, they can neglect participants' accounts and in some cases sustain biased assumptions. This is particularly problematic given that one's body is not only perceptually accessible to oneself but also to others, therefore carrying complex informational layers in contrast to other features of experience. Without pretending to fundamentally solve methodological nor epistemological issues from qualitative and quantitative research, we propose a conciliatory take, offering tools for three steps of the inquiry: the experimental design, data collection, and data analysis. This mixed-methods approach hopes to account for individual differences, discover insights in nuance, foster multidisciplinary, and potentially move quicker in some aspects of the research program.

Location: Cafeteria
Poster 86

“Hurry up!”: Investigation of human postural and locomotor parameters under threat anxiety-inducing context.

Morgan Beaurenaut, Carole Ferrel, Sylvie Vernazza-Martin, Rocco Mennella

Adaptation to environmental challenges is pivotal for survival. As the spatio-temporal proximity to danger narrows, and contingent upon available action opportunities, a cascade of motor, cognitive, and emotional defensive reactions ensue. Given the well-preserved nature of these prototypical defensive reactions and their shared neural bases across species, the exploration of human responses under threat is commonly approached from a translational perspective. However, despite significative advancements, these reactions remain partially unexplored in humans. In particular, while human post-encounter threat responses have received considerable attention, this is less so for adaptive anticipatory anxiety. Furthermore, so far, investigations of human behavioral adaptations to threatening situations primarily occur in static experimental settings, recorded through computer keyboard and mouse, compromising the detection of complex motor modulations. To address these limitations and highlight relevant motor markers of anxiety, we recruited 25 participants and instructed them to passively walk under two alternating contexts: one involving exposure to unpredictable distress screams (anxiety-inducing condition) and the other without aversive stimulation (neutral-control condition). Participants' posture and gait were recorded thorough a force platform and a 3D motion capture system. The results revealed that in anxiogenic contexts, participants exhibited a shortened stride length duration and reduced stance phase, accompanied by an increase in the amplitude of the arms and legs swing. Altogether, and in line with the literature on predation, our findings suggest that anxiety induction in humans potentiates action, possibly supporting flight or avoidance. Future research should investigate how locomotion parameters vary, based on environmental constraints and inter-individual variability.

Location: Cafeteria
Poster 87

Eyes and No Eyes: Unraveling the Influence of Interoceptive Signals on the Processing of External Sensory Stimuli

Arianna Schiano Lomoriello, Alejandro Luis Callara, Ivana Konvalinka

Social interactions require an understanding of others' emotional states, which are often not communicated explicitly and must be inferred. Since emotional experiences are intertwined with visceral or interoceptive bodily states, accurate inference of others' interoceptive states can provide insight into their emotional state. Yet, the degree to which people can infer these interoceptive states from visual cues remains uncertain. Recent evidence suggests that individuals can identify the likely owner of a sequence of heartbeats better than chance based on visual cues, raising questions about the self and other mechanisms involved in humans' ability to infer bodily states from visual information. We explored whether this ability depends on the interoceptive abilities of both the observer and the observed person, assessed through two interoception tasks: the counting task and the heart rate discrimination task. We designed a two-alternative forced-choice task in which 36 participants had to guess the owner of a set of heartbeats by watching videos showing two people side-by-side in two different conditions (frontal and back perspective) and visual feedback of the heartbeats of one of the individuals in the center. Results supported earlier findings, indicating that participants identified the likely owner of the heartbeats above chance. While accuracy increased when observing from behind—hinting at potential information overload from facial cues in the frontal condition—we found that higher interoceptive abilities correlated with better performance, but only in the frontal condition. These results suggest that one's interoceptive skills influence the inference of others' states in situations with potential confounding signals.

Location: Cafeteria
Poster 88

Virtual and physical active tool-use training do not change time perception in peripersonal or far space

Amir Jahanian Najafabadi, Christoph Kayser

Previous work has suggested that our perception of time is plastic and dependent on the distance of the stimulus to our body. For example, Anelli et al (2015) showed that stimuli presented in peri-personal and far-space are judged differently, and that this distance-effect on time perception can be shaped by training participants with a tool that effectively extends the reachable space. We here aimed to replicate and extend these results using a paradigm in which we tested time perception at multiple distances from the body prior to and following active tool-use training.

In two independent studies, we probed 60 participants on three temporal tasks (visual bisection, visual categorization, auditory categorization) for stimuli presented at three distances from the body (60cm, 120cm, 240cm) presented in physical and virtual reality environments. In between testing blocks, participants performed blocks of tool-use training whereby they used a physical, or a virtual mechanical grabber to move coins at a distance of 120cm from the body. For each task we tested for an effect of spatial distance, tool-use training and their interaction. Results suggest that in both virtual and real environments, time perception is not affected by the distance of the stimulus to the body, and is not shaped by extension of the action-related body by tool-use training. Hence they call into question to what degree and how robustly time perception is shaped by the distance of the probe to the body and how malleable this is by extension of the peripersonal space by tool-use training.

Location: Cafeteria
Poster 89

The impact of group membership on sensorimotor simulation: a focus on embodied prediction of others' movements

Lize De Coster, Ana Tajadura-Jiménez, Bernhard Spanlang

Social interaction lies at the core of our daily life. While research shows that group membership, such as race, affects these social interactions, studies investigating the influence of group membership on the automatic tendency to simulate others' sensorimotor states have resulted in mixed evidence. For example, research studying automatic imitation using the imitation-inhibition paradigm, where an observed hand makes congruent or incongruent movements compared to participants' movements, has failed to show a reliable effect of group membership. This is in contrast, however, with studies looking at sensorimotor simulation during face-to-face interactions with virtual avatars, that showed that racial membership affects simulation of our interaction partner's movements, but only when embodied prediction of these movements is necessary. In the current study, we aimed to reconcile these conflicting findings using an adapted version of the imitation-inhibition paradigm that explores the role of embodied prediction and its timing. In a series of two experiments, we showed that racial membership affects sensorimotor simulation during automatic imitation only when embodied prediction of others' movements is necessary for successful interaction, and that this mechanism is especially important during response preparation phases. This provides important insights into the extent of the influence of group membership on core low-level mechanisms that are fundamental to our social interactions. Furthermore, these results also question motivational theories that postulate that we automatically imitate ingroup members more than outgroup members, instead indicating that a close link between motor simulation and action prediction might be fundamental for inter-individual differences to play a role.

Location: Cafeteria
Poster 90

The differential role of alexithymia and interoception in liking and wanting components of reward responsiveness

Cinzia Cecchetto, Sofia Adelaide Osimo, Elisa Dal Bò, Claudio Gentili, Marilena Aiello

Both alexithymia, a psychological construct characterized by diminished affective abilities, and deficits in interoception, which consist in difficulties in perceiving internal bodily signals, including the one associated with emotional states, result frequently associated with behavioral addictions, which are characterized by abnormalities in processing of rewards. However, the relationship between alexithymia, interoception difficulties, and reward responsiveness in healthy individuals, have not been systematically investigated. In particular, the present study aims to clarify the role of alexithymia and interoception difficulties in the two components of reward responsiveness: the anticipatory (liking) and the consummatory (wanting) components. Healthy participants (n = 303, 253 women) completed questionnaires to measure alexithymia (TAS-20), interoception difficulties (ISQ), and anticipatory and consummatory pleasure (TEPS). Moreover, they were asked to rate food images in terms of “How much do you like it” (liking rating) and “How much are you willing to pay for it” (wanting rating). Linear regression analyses showed that higher scores of TAS-20, indicating higher levels of alexithymia, and higher scores of ISQ, indicating higher levels of interoception difficulties, are associated with lower anticipatory and consummatory pleasure and lower food liking. No significant effects were found for food wanting. However, mediation analyses revealed that interoception deficits is a stronger predictor for the anticipatory component, while alexithymia is a stronger predictor for the consummatory component. While preliminary, these results suggest a differential role of interoception and alexithymia in the liking and wanting components of reward responsiveness, and add new perspectives for the investigation of reward responsiveness in excessive behaviors.

Location: Cafeteria

Poster 91

When the interoceptive and conceptual clash: the case of oppositional self-modelling in Tourette's syndrome"

Liberty Severs, Darius Parvizi-Wayne

Tourette syndrome (TS) has been associated with a rich set of symptoms that are said to be uncomfortable, unwilling, and effortful. However, a formal account that integrates these discrete symptoms into an overarching theoretical framework is currently absent from the field. In this study, we elucidate the relationship between hierarchical generative modelling and TS symptomatology within an active inference framework. We then cast the aberrant action-perception loops characteristic of TS as the cause of a conflict of inference over the state of the organism's agency and self-coherence, leading to what we term oppositional self-modelling (OSM). To buttress this theoretical account of altered self-experience, we aim to empirically discern the relationship between self-conception and a diagnosis of TS using self-report questionnaires. We also explore, both theoretically and empirically, the role of cognitive effort in TS during a Number Switching Task. We hypothesise that: i) those with a diagnosis of TS will report a disturbed sense of agency and self-narrative, since their belief in (endogenous) agency has been weakened through the performance of tics and ii) that this effect is moderated by their capacity to exert effort, such that a greater capacity to exert effort, as measured by our empirical task, should map onto a stronger sense of agency and coherent self-narrative in TS sufferers. This is because such an ability should apply too in contexts of effortful tic suppression, which serve to confirm the agent's higher-order belief that an epistemic agent lies at the heart of their generative model.

Location: Cafeteria
Poster 92

Prolonged exhalation Influences Risk Decision-Making

Wenhao Huang, Soyoung Park, Mine Schmidt, Lokyan Lam, Felix Molter, Ignacio Rebollo, Gabriele Bellucci

Breathing is an essential physiological function for gas exchange with the environment. However, specific breathing patterns can modulate the sympathetic nerve system, thereby changing neural processes. Previous research has highlighted its role in anxiety and stress, yet its influence on human decision-making remains unknown. In this study, we investigated how a prolonged exhalation (ProlEx) breathing pattern modulates risk decision-making and its underlying neural and psychophysiological mechanisms. In a repeated-measures within-subject design, 32 (mean age 24.50 ± 4.91 years old, 17 females) healthy subjects participated in a risk decision-making task, while engaging in specific breathing conditions: prolonged exhalation (ProlEx) and normal breathing pattern (Eupnea). The task required participants to assess and indicate their willingness to engage in various gambles, each characterized by specific potential gains and losses while taking different breaths. The major findings of our study revealed that compared to Eupnea, the ProlEx facilitated accepting gambles. Interestingly, the impact of different breathing patterns on decision-making varied depending on the potential gains and losses involved, suggesting ProlEx enhances sensitivity towards increasing rewards and reduces loss aversion. Our study uncovers the neural and psychophysiological mechanisms modulating risky choices caused by different breathing patterns.

Location: Cafeteria
Poster 93

Transcranial direct current stimulation over motor cortex or prefrontal cortex both facilitate balance training in older adults

Hadis Imani, Ben Godde

Kaminski et al. (2017) revealed that anodal-tDCS over M1 produced improvements in balance performance compared to sham in young but not older adults (OA). Assuming that particularly in OA facilitation of executive functioning and motor control could also support balanced performance, in this study we extended these previous findings by targeting the left DLPFC.

In three sessions which were each one week apart, in a randomized crossover design, seventeen OA (60-80 years) received a-tDCS over either F3 or Cz (cathode placed over the right frontal orbit) or sham stimulation while practicing on a balance platform for 20 minutes. The following balance tests (14 trials, 10 seconds each, with 5 to 10 seconds rest between trials) were done at the beginning and at the end of each session: (a) balancing on both feet with eyes open, (b) balancing on both feet with eyes closed, (c) balancing in one-leg stand (test order was randomized). The center of gravity was continuously recorded and pathlength per second in x and y direction was calculated as a performance measure. General linear model analysis with path length as dependent variable and test session (pre, post) and tDCS condition (Cz, F3, sham) as within factors revealed tDCS condition by session interaction effect ($F(2,-3.813) = 16.5$, $p < .01$, $\eta^2 = 0.021$). Our results confirm facilitating effects of tDCS on balance training independent of the target region (Cz or F3). Probably the optimal target region could be in the overlap area, e.g., the left premotor area.

Location: Cafeteria

Poster 94

Exploring cardiac, gastric, and urinary interoception in women with Endometriosis

Chiara Cantoni, Sofia Ciccarone, Maria Grazia Porpora, Salvatore Maria Aglioti

Endometriosis is a condition characterised by chronic pelvic pain and visceral hypersensitivity which, like other chronic pain conditions, may lead to altered levels of interoception. The main aim of the present study is to probe interoceptive differences between patients with endometriosis (EP) and healthy women (HC). 30 EP (age: 32.93 ± 6.58) and 30 HC (age: 31.6 ± 6.88) underwent three interoceptive tasks: the Heartbeat Counting Task (HCT) to assess the cardiac domain, the Water Load Test-II (WLT-II) to assess the gastric domain, and a novel Urinary Interoceptive Task (UIT) for the bladder domain. Participants also completed measures of interoceptive bladder sensibility and subjective ratings of pain for each endometriosis symptom (i.e., dysmenorrhea, dyspareunia, dyschezia, chronic pain). Results showed a positive correlation between the WLT-II and the UIT in all participants ($R=0.47$, $p<0.001$), indicating that the higher the gastric interoceptive alteration, the higher the urinary one. Moreover, compared to healthy controls, women with endometriosis exhibited lower scores in WLT-II ($t(58) = 4.6814$, $p < 0.001$) and UIT ($t(39.931) = 5.1462$, $p < 0.001$), but higher scores in subjective bladder sensibility questions ($t(57.346) = -4.0304$, $p < 0.001$), suggesting a dissociation between EP's poor objective performance on interoceptive tasks and their high subjective belief to focus on physiological signals. UIT scores were associated with pain symptoms (Estimate: -0.00440 (SE = 0.00228 , $Z = -1.93$, $p = 0.054$), suggesting that patients, probably due to habituation to chronic pain, struggle to ignore discomfort sensations, resulting in reduced accuracy in detecting physiological signals coming from the pelvic area.

Location: Cafeteria
Poster 95

A new task for measuring gastric interoception: the multi-trial Water Load Test

Olivia Carrubba, Giorgia Ponsi, Marina Scattolin, Maria Serena Panasiti, Giuseppina Porciello, Salvatore Maria Aglioti

Research developing interoceptive measures focused on the cardio-respiratory domain, leaving other bodily axes, particularly the gastrointestinal realm, understudied. In the widely adopted two-step Water Load Test (WLT-II), gastric interoceptive accuracy (GIAcc) is conceived as the discrepancy between perceived satiety and gastric fullness. However, this may map onto different subjective thresholds in perceiving these states rather than providing an interoceptive measure. To overcome this confound, we developed a new version of this task – the multi-trial Water Load Test (mtWLT).

Eighty-five healthy volunteers ingested predetermined amounts of water, via different drinking modalities, and provided ratings for fullness, satiety, thirst, and nausea. The task ended when the maximum gastric fullness was reported. A cardiac measure of IAcc was also collected. We computed a trial-by-trial GIAcc measure, defined as the difference between self-reported gastric fullness and the estimated objective fullness, and tested whether and to what extent the perceived gastric sensations could predict this measure. Results showed that perceived fullness negatively predicted trial-by-trial GIAcc only in the initial and mid-stages of the task (when water intake was low). Similarly, perceived thirst negatively predicted trial-by-trial GIAcc only when participants' stomachs were relatively empty. Interestingly, while sensations of satiety did not predict GIAcc, perceived nausea predicted GIAcc as water intake increased. No correlation was found between gastric and cardiac accuracy.

The mtWLT acknowledges gastric interoception's multifacetedness by capturing the distinct role of various gastric sensations depending on the stomach's fullness state. Its non-invasive nature holds significant potential for investigating gastric interoception also in clinical populations.

Location: Cafeteria
Poster 96

CAN PRESCHOOL CHILDREN USE COGNITIVE REAPPRAISAL? Understanding the role of attachment relationships in the development of this emotion regulation strategy.

Adriana Olaya Torres, Franco Medina

Cognitive reappraisal (CR) is an emotion regulation strategy that requires changing the meaning of a situation that triggers an emotional response. The evidence has shown this strategy as one of the most adaptive regulation strategies because of its positive effects studied in adults. Nonetheless, the scarce research on children population has been warned. This gap is observed especially between 4 and 6 years old. Studies that have examined CR in children have used maternal reports to evaluate the frequency of use and neural measures to evaluate the effectiveness. Some studies have demonstrated the suitability of event-related brain potentials recorded using electroencephalography (EEG); a trend that has seen exponential growth over the last ten years. In particular, the late positive potential (LPP), is a reliable neural correlate of CR effectiveness in children. Evidence has shown consistently that precursors of emotion regulation strategies are comprised of different aspects. However, the knowledge about the precursors of CR is still emerging.

This project aims to examine whether CR at preschool age is associated with child-mother attachment security. Multiple measures will be employed including the Strange Situation Procedure to assess attachment relationships, maternal reports of emotional regulation, dyadic tasks to observe the frequency of CR, and neurophysiological (EEG) measures to assess the effectiveness of CR through the LPP. We hypothesize that higher levels of attachment security predict greater effective and frequent use of CR and that the relationship between attachment security and CR frequency is mediated by the effectiveness of the strategy.

Location: Cafeteria
Poster 97

Association Between Maternal Sensitivity and Infant's Neural Response to Social Touch

Isabella Germinhasi Francischelli

Maternal sensitivity is the ability to correctly interpret and respond to children's needs and communications. Touch is an important part of the mother-child relationship and a means through which sensitivity is expressed. However, studies evaluating infants' neural response to social touch and its association with maternal skills are scarce. This study aims to assess the association between maternal sensitivity and infants' neural response to maternal social touch. Previous findings from our team demonstrated that decreased sensitivity at 7 months correlated with heightened activation in somatosensory and temporal regions in response to gentle brush strokes at 12 months on the shoulder blade (Mateus et al., 2021). Given the methodological differences of the present study (age and stimulation), no specific hypotheses will be defined. Fifty-five infants and their mothers will be evaluated longitudinally in two moments. At 6 months, maternal sensitivity will be coded using Ainsworth's Maternal Sensitivity Scale, applied to 9-minute parent-child interaction videos in which the mother was asked to play with her child. At 10 months, infants' neural responses to maternal social touch will be accessed using functional near-infrared spectroscopy (fNIRS). The following procedure will be used: Touches will be applied to the infant's shoulder blade by a hidden researcher behind a curtain. There will be 8 trials (baseline + touch); the mother will be sitting next to the infant, giving them the impression that she is the one touching them. We expect to expand the understanding of the relationship between maternal behavior and infant social touch processing.

Location: Cafeteria
Poster 98

Early-life environmental factors, avoidance patterns and clinical symptoms of anxiety and depression in young adults: a planned research project

Carolina Knihs de Camargo, Jesmin Pervin, Jena D. Hamadani, Shamima Shiraji, Monjur Rahman, Shams El Arifeen, Eva-Charlotte Ekström, Syed Moshfiqur Rahman, U Tin Nu, Anisur Rahman, Maria Kippler, Malin Gingnell

Introduction: The remodeling of brain structural connections and puberty onset within adolescence years can lead to significant biological stress, which might affect the risk of developing affective disorders. Previous literature also indicates that socioeconomic conditions and major life events might influence the risk of mental disorders. However, little is known about how early-life environmental factors, especially during puberty, mediate resilience or vulnerability to mental illness during young adulthood. We aim to evaluate how these environmental factors during early life and puberty affect mental health deterioration in adulthood and how this relates to avoidant behavior.

Methods: Data will be collected within the MINIMat cohort, established between 2001-2004 in Bangladesh, where the participants have been followed-up during different developmental stages. We aim to collect data from 1,000 participants using questionnaires for retrospective childhood trauma (CTQ), current psychosocial conditions (CPAS), mental health (STAI, MADRS, SDQ, and PCL-5), and avoidance behavior (iAAT). The data collection is planned to start in early 2024, with a pilot study. Data analysis will be done using regression models, after adjustment for confounders.

Hypotheses and relevance: Our main hypotheses are that environmental factors during early life and puberty impact both mental health and the presence of avoidant behavior in adulthood, and that avoidant behavior is more pronounced in participants with ongoing affective mood symptoms. We understand that this study will contribute to the understanding of early resilience and risk factors for mental illness, which may support future preventive policies.

Location: Cafeteria
Poster 99

Vocal smile in children: Mental representation and facial motor resonance

Zoé Ranty, Marie Gomot, Annabelle Merchie, Jean-Julien Aucouturier, Claire Wardak

Emotional contagion triggered by visual smile through visuo-motor resonance has been widely described since early childhood. The development of a similar phenomenon in the auditory modality, i.e. emotional contagion by vocal smile expressed through emotional prosody, remains poorly documented.

The objective of the present study was to characterize mental representation of vocal smile and motor resonance it might evoke in 8-12 years old children (n=12) compared to adults (n=25).

Mental representation of vocal smile was determined through the method of reverse correlation. Participants had to determine, among 2 /a/ phoneme which one was the more smiling. Facial motor resonance was explored via electromyography through measures of Corrugator Supercilii (CS) and Zygomatic major (ZM) muscles activity. Meanwhile, participants were judging semantically neutral sentences to which smiling or non-smiling acoustic filters were added.

Children rely on the same subtle acoustic cues as adults to categorize a smiling voice and automatically smile (ZM contraction) when listening to a smiling sentence. However, sentence judgment leads to differentiated motor resonance, associated with CS activity in adults and ZM activity in children. Thus, while the perceptual representation of vocal smile matures early on, the emotional interpretation of the stimulus differentially impacts motor resonance in children and adults.

These findings provide developmental insight into emotions theories on the feed-back loop between facial expressions, vocal emotions perception and emotional experience. Motor resonance to vocal emotion in children seems robust but should be confirmed on a larger sample, to be collected as part of final study.

*Location: Cafeteria
Poster 100*

Neural responses to maternal touch compared to touch by an unfamiliar woman among 6-month-olds.

Livia Campos, Sérgio Luiz Novi Jr, Rogério de Oliveira, Camila Fragoso Ribeiro, Isabella Germinhasi Francischelli, Beatriz van der Heijden Cardernes, Rickson Coelho Mesquita, Ana Alexandra Caldas Osório

A pioneer study showed that 9-month-old infants displayed lower heart rate ratios when they believed to being touched by their mothers as opposed to an unfamiliar woman. However, no neuroimaging studies have been conducted to understand possible differences in the neural responsiveness to maternal touch – this is the main aim of our study. Seventeen 6-month-old infants were assessed using fNIRS according to the following procedure: touch was applied to the infant's shoulder blade by a trained experimenter hidden behind a curtain on 16 trials (baseline + touch). In half of the trials, the infant was seated next to their mother, and in the other half, next to an unfamiliar woman. Results showed that maternal touch activated (versus baseline) the channels on the following regions of the left hemisphere: Primary Somatosensory (SI), Middle Temporal Gyrus (MTG), Temporoparietal Junction (TPJ), Superior Temporal Sulcus (STS), Posterior Superior Temporal Sulcus (pSTS); and on the right hemisphere it activated the SI, Secondary Somatosensory (SII), STS, pSTS and MTG. Meanwhile, the unfamiliar woman's touch activated channels in the following regions of the left hemisphere: SI, SII, MTG, and TPJ, and on the right hemisphere, it activated the MTG and pSTS. In conclusion, maternal presence influenced brain responses to touch at 6 months. The predominant left hemisphere activation in the mother touch condition suggests that a partial lateralization process occurs at such young age, which is an indicative of a maturation process, highlighting the importance of maternal touch to infants' social brain development.

Location: Cafeteria
Poster 101

Age differences in Interoceptive Sensitivity and Emotional Memory

Sophie Cawkwell

Interoception is known as the sensation of internal bodily signals, e.g., heart rate and breathing. The sensation of these signals has consistently been associated with emotional feeling states, thus reflecting a close body-to-mind relationship. Recent evidence indicates mixed findings in the relationship between interoceptive ageing and emotional reactivity, suggesting age-related changes in mind-body connections.

The present study recruited young and older adults to examine interoceptive sensitivity and its effects on emotional memory. Participants (N = 80) aged 18-77 were asked to complete the Multidimensional Assessment of Interoceptive Awareness (MAIA-v2) to assess subjective interoceptive sensibility (IS) alongside a heartbeat counting and a heartbeat discrimination task (HDT) to measure interoceptive accuracy (IAcc). Following participation in an emotional face-name learning task involving angry, neutral, and happy expressions, participants were assessed on how accurately they could recall faces prompted by a name cue.

Findings suggested an age-related increase in IS with older adults placing higher trust in their physiological signals compared to young adults. Similarly, IAcc increased with age when measured using the HDT. Face-recall accuracy was poorer in old relative to young adults. However, when controlling for IS and IAcc, MAIA-v2 Trusting and HDT emerged as positive mediators for the relationship between age and neutral face-recall, suggesting that higher interoception scores contributed to better recall of neutral faces. Our findings suggest the importance of interoception as an influential factor in memory recall for socially relevant stimuli throughout the lifespan.

*Location: Cafeteria
Poster 102*

Plasticity of body schema and peripersonal space across the lifespan

Amir Jahanian Najafabadi, Alireza Rastegari, Sara Mohammadi, Nakisa Nourzadegan, Hadis Imani

Recent studies have shown plasticity of body schema in middle puberty and young adults compared to middle age and older adults using tool-use paradigm (for review, Martel et al., 2021; Jahanian Najafabadi et al., 2023ab, Miller et al., 2014). In this study, we aimed to replicate and expand on prior research by investigating whether active tool-use training in near and far spaces induces changes in body schema and peripersonal space across the lifespan. Eighty-three right-handed participants (12-80 years) underwent active tool-use training to grasp objects at varied distances (60 & 100 cm). Participants completed two blocks of tool-use training including 60 trials in a counterbalanced order at each distance. Body schema and peripersonal space were measured using a tactile distance perception task and a reaching distance estimation task respectively. Our results revealed significant differences in the tactile distance perception of the forearm among age groups ($P < .001$). Adolescents and younger adults incorporated shorter tools in their sensorimotor representation, but not observed in middle-aged and older participants. Moreover, younger aged and middle-aged individuals incorporated longer tools in their forearm body representation compared to other groups. Additionally, perceived peripersonal space changed in middle-aged and older adults using both shorter and longer tools compared to younger ages ($P < .001$). This suggests that body schema plasticity varies with tool size and age across near and far spaces. In summary, these findings highlight age-related differences in body schema plasticity and peripersonal space during tool-use, indicating distinct patterns across the life span.

*Location: Cafeteria
Poster 103*

Investigating the neural basis of return of fear across development

Ebba Widegren, Johanna Motilla Hoppe, Johan Vegelius, Daniel Pine, Karin Brocki, Malin Gingnell, Andreas Frick

Fear learning and its neurobiological foundation is thought to change throughout development. Previous findings indicate that adolescence is a period characterized by diminished fear extinction and increased return of fear compared to childhood and adulthood, but findings have been mixed. The present study is the first to investigate return of fear in typical development from childhood to adulthood, aiming to elucidate potential differences in return of fear and its neural correlates across development.

120 participants (65 female), between 6 to 40 years (35 children, M(SD) 8.1 (0.7) years, 41 adolescents M(SD) 13.6 (1.2) years, and 44 adults, M(SD) 34.8 (3.3) years) underwent a two-day Screaming Lady fear conditioning paradigm. Habituation, acquisition and extinction were assessed on the first day using skin conductance response (SCR) and ratings of fear and worry (1-5). Return of fear was assessed in a magnetic resonance imaging (MRI) scanner >24 hours later using functional MRI (fMRI), SCR, and fear and worry ratings. Preliminary linear mixed models showed that fear was acquired across age groups, with a stimulusXtrial interaction with higher SCR to the conditioned stimulus paired with an aversive sound (CS+) compared to SCR to the CS never paired with an aversive sound (CS-). Return of fear was evident across age groups, with no group differences in SCR. However, adolescents displayed heightened amygdala reactivity (CS+>CS-) during the return of fear phase compared to children and adults.

The findings indicate age-dependent differences in the neurobiology underlying return of fear in humans, specific to the adolescent period.

Location: Cafeteria
Poster 104

Exploring the Inverted-U Relationship between Stress and Conflict Adaptation in a New Stroop-like Stress Task

Jin Yan, Frenn Bultinck, Liwen Meng, Wout Coolen, Henk van Steenbergen

Introduction: The relationship between stress and cognitive functions is commonly believed to follow an inverted-U-shaped curve, although this idea has not been thoroughly examined. In this project, we developed a new Stroop-like stress task to investigate the transition from functional to dysfunctional effects of stress on adaptive cognitive control within and between individuals.

Method: In two independent studies, healthy adult participants completed our new stress task, which consisted of four blocks of increasing difficulty and real performance feedback. Study 1 (n = 41) assessed subjective feelings, while Study 2 (n = 54) additionally recorded continuous cardiovascular activities.

Results: Across both studies, participants reported a gradual increase in subjective stress levels. In Study 2, cardiovascular responses, particularly total peripheral resistance, followed a similar ascending pattern across the four blocks. Within-subject regression analyses on the behavioral data showed subjective stress had no significant impact on adaptive cognitive control, as assessed by the conflict adaptation. However, between-subject analyses showed that in Study 1, subjective stress positively predicted conflict adaptation only under the relatively mild stress condition (during the first two blocks). In Study 2, an inverted-U shaped pattern between subjective stress and conflict adaptation emerged regardless of the stress condition.

Conclusion: The Stroop-like Stress task can induce increasing psychological stress and threat-related cardiovascular responses. Consistent with the inverted-U account, our findings across both studies tentatively suggest that mild but not severe stress might increase conflict adaptation. However, further studies are needed to verify the robustness of this curvilinear pattern.

Location: Cafeteria
Poster 105

Forms of Repetitive Negative Thinking Differentially Relate to Posttraumatic Stress Versus Growth Following Trauma Exposure.

Laura Mertens, Kristof Hoorelbeke

Background: Posttraumatic stress disorder (PTSD) is a highly invalidating disorder, with a lifetime prevalence of 3.9%. Little is known about the involvement of cognitive processes in the development and maintenance of PTSD. In line with cognitive models of PTSD, such as the cognitive model by Ehlers and Clark (2000) and the metacognitive model of Wells (2000), recent findings suggest that repetitive negative thinking (RNT) may play a crucial role in PTSD symptom development. This presentation will focus on the role of different forms of RNT and related factors (e.g., metacognition, effortful control), and how these uniquely relate to PTSD symptom severity versus growth following exposure to a traumatic event. **Methods:** To examine the unique interrelations among these variables, we conducted network analysis on cross-sectional data collected from two general population samples consisting of individuals meeting Criterion A for PTSD (for each sample N approximates 350). Different forms of RNT, positive and negative beliefs about RNT, need for control, effortful control, posttraumatic growth and symptom severity were included in the analyses. **Results:** The obtained network models suggest a central role for depressive rumination, deliberate rumination and negative beliefs about RNT. Each form of RNT showed unique associations with PTSD symptom severity. The relationship between deliberate rumination and posttraumatic growth appeared to be the strongest among the edges included in the model.

Location: Cafeteria
Poster 106

Foreign junior female medical students do experience acute stress in the new environment as evidenced in a virtual model.

Ketevan Janashia, Ana Chikviladze, Aleksandre Ramishvili, Nikoloz Tvildiani

Studies have shown that junior medical students, especially foreigners (F), experience psychological stress due to new environments. Sensorimotor reaction times (SMRT) measurement is an important tool for assessing a person's adaptation to stress. Study was conducted on F-(n=13)/ local (L)-(n=11) junior healthy female medical students. Participants were exposed to two randomized order simulated visual tasks using simple/discrimination SMRT (SSMRT/DSMRT). The correct answers (CA%), means (M), standard deviations (SD), and residual standard deviations (RSD) during SSMRT/DSMRT for both groups were calculated: M-SCA1= 85.9%; SD- SCA1=10.7; RSD-SCA1=2.964; M-SCA2= 86.6%; SD-SCA2=4.3; RSD-SCA2=1.616; M-DCA1= 50.2%; SD-DCA1=7.2; RSD-DCA1=1.987; M-DCA2= 54.6; SD-DCA2=4.9; RSD-DCA2=1.85. M-SSMRT1=0.352s; SD-SSMRT1=0.1077; RSD-SSMRT1=0.02988; MDSMRT1=0.7092s; SD-DSMRT1=0.1476; RSD-DSMRT1=0.04094; M-SSMRT2=0.3519s; SD-SSMRT2=0.09406s; RSD-SSMRT2=0.03555; M, DSMRT2=0.6403s; SD- DSMRT2=0.2219; RSD-DSMRT2=0.08388). There were no statistically significant differences between the different means for CA. Although the SD/ RSD-SSMRT in F-students was much higher than in L-students, indicating some neuroticism experienced by F-students, which appears in hyperactive responses. There were no statistically significant differences between the different means for RT. Calculation of Pearson correlation-r and coefficient of variation - (CV=SD/Mean) revealed: $r=0.7552$; $CV-SSMRT1=0.305966$; $CV-DSMRT1=0.208122$; $CV-SSMRT2=0.267292$; $CV-DSMRT2=0.346556$. There was a linear relation between the means and SD, and higher CV DSMRT for L-students compared to F-students indicating less concentration of attention in L-students. Conclusions: The parameters of mental chronometry in F/L junior female students are the same. Some neuroticism in F-students can be explained by the presence of certain stress which is related to the difficulty adapting to a new environment. However, F-students can concentrate better than L-students on discrimination tasks.

Location: Cafeteria
Poster 107

Nature's effect on stress and eating behaviour: four lab experiments on nature aspect differentiation

Nathalie Michels

Despite well-recognised health benefits of nature, it is still unclear which nature aspects (colour, smell, sound,..) can counteract stress and whether nature also influences eating behaviour. Potential pathways are emotion regulation, impulse-inhibition, nudging and interaction with neurotransmitters. Before and after Trier Social Stress Test, participants were exposed to 1) one of four slideshows with in green or grey shades: nature or urban environments (n=81); 2) one of four slideshows with interiors including plants or objects (n=92); 3) one of three sound tracks of birds, streaming water or wind as control (n=59); 4) one of three odors of pine tree, grass or water as control (n=91). Group differences were tested on perceived restorativeness, heart rate variability (HRV), salivary cortisol, affect, food craving and food choice.

Results: Reported restorative power was highest for the green nature/plant group. Nature pictures were more beneficial via lower HRV and negative emotions reactivity. Only study 2 showed more vegetable wanting and less snack wanting in the green plants group. Both bird and water sounds led to better cortisol recovery (not reactivity) and were reported to be more stress reducing, but no differential effects on eating behavior were found. Both pine and grass odor led to more cortisol decrease in a non-stress situation. Grass led to more vegetable wanting in non-stress, but both odors also led to unhealthy snacks after stress.

Conclusion: For stress and diet interventions, plants seem most important but green colours or other sensory elements like smell and sound can sometimes help.



May 23^d – 2:00pm – 3:30pm

SYMPOSIA

Thursday, May 23rd 2024 // 2:00pm -3:30pm

*Location: Auditorium 2
Symposium 7*

The Drive to Survive: A new look at cognitive and neural mechanisms that support successful avoidance.

Dennis Hernaus, Catherine Harmer, Yanfang Xia, Debbie Yee

Avoiding aversive outcomes - including injury, loss, and negative emotional states - is vital to survival. But how and when should we decide to avoid? In this symposium, we bring together four international researchers who will highlight cognitive, neural, and pharmacological mechanisms essential for successful avoidance of aversive outcomes. Key topics include how we maintain control over aversive situations, how we learn, become motivated, and spend energy on avoiding such outcomes, the neuropharmacological underpinnings of these computations, and their relationship to mental health problems. Together, these results provide an interdisciplinary overview of the complex nature of avoidance decisions.

Talk 1 – Catherine Harmer

Is loss sensitivity relevant for antidepressant drug action?

Depression has been associated with increased sensitivity to loss (compared to reward) across a number of studies exploring probabilistic learning. However, the effects of antidepressant drug treatment, such as selective serotonin reuptake inhibition, has been relatively inconsistent. In this talk, I will discuss naturalistic data which shows a reduction in loss (but not reward) sensitivity in participants taking SSRIs for depression. A follow-up study also revealed that specifically increasing serotonin release with fenfluramine decreased sensitivity to loss in healthy controls compared to double blind administration of placebo. I will also present the results from a study exploring the effects of double blind placebo controlled iv ketamine in healthy participants in both behavioural paradigms and with high resolution imaging of habenula and associated networks during loss. This work may help unpick the mechanisms underlying ketamine's fast acting effect on depression and on anhedonia.

Talk 2 – Yanfang Xia

Arbitrating between distinct behavioral control strategies for adaptive stress coping

We face many stressors. Some are controllable and can be avoided, other stressors are uncontrollable. To adaptively cope with the many stressors around us, we need a meta-level ability to select the right behavioral control strategy at the right moment. How do we do this? We propose that adaptive stress coping involves flexible arbitration between cognitively effortful instrumental and frugal Pavlovian control strategies based on dynamic estimates of stressor controllability. Moreover, we hypothesize that recruitment of these distinct strategies implicates distinct sympathetic and

parasympathetic neurophysiological stress responses. To test this, we are developing a Go/NoGo-to-avoid-Shock learning task requiring subjects to learn both Pavlovian-congruent NoGo-to-avoid-shock responses and Pavlovian-incongruent Go-to-avoid-shock. This allows us to quantify reliance on a Pavlovian as opposed to an instrumental control strategy, which manifests as greater Pavlovian biases: greater tendency to NoGo-to-avoid than Go-to-avoid. Outcome controllability is manipulated by fluctuating action-outcome contingency over time. We anticipate greater Pavlovian bias and reduced sympathetic stress responses in uncontrollable versus controllable task-phases. The paradigm will also allow us to assess failures to adapt strategy selection to changes in controllability, as implicated, for example, in learned helplessness.

Talk 3 – Debbie Yee

Motivational context determines the strategic allocation of aversive outcomes on cognitive control

Aversive motivation is a powerful driver of how we decide to allocate mental effort. For instance, when pursuing cognitively demanding goals (e.g., studying for an exam), our desire to avoid negative outcomes (e.g., avoiding failure) is immensely powerful for determining effort investment. However, one challenge is that the influence of aversive outcomes on behavioral control is much less parsimonious than rewards (e.g., animals will produce a wide range of behavioral responses to avoid or escape from detected threats). How can we reconcile these findings? Here, we combine computational modeling, fMRI, and our novel Multi-Incentive Control Task and show that motivational context – whether an outcome promotes reinforcement or punishment – is crucial for determining one's effort profile. Specifically, aversive outcomes led participants to either increase their caution (increased threshold) or their speed/efficiency (increased drift rate) depending on whether the outcomes were varied in the context of a punishment or a (negative) reinforcement, respectively; and changes in task performance in the face of increasing negative reinforcement mirrored those observed with increasing positive reinforcement. These dissociable strategies were well-accounted for by the Expected Value of Control model, which configures cognitive control by maximizing reward rate and minimizing effort costs. Finally, we present preliminary data linking individual differences in these effort strategies to anxiety and depressive symptoms. Collectively, this work sheds new insight into how people differentiate between diverse aversive inputs to determine how much and what kind of mental effort to exert, which can help inform important variability in predicting psychiatric symptoms.

Talk 4 – Dennis Hernaes

Balancing the costs and benefits of survival

When should we invest energy in avoiding threats? On the one hand, we should always want to invest energy in avoiding threats, given the potentially devastating consequences they might have (e.g., injury, pain). On the other hand, it wouldn't be

wise to waste energy on all – even extremely unlikely - threats, given that we only have a limited supply, and there are so many nice things that we could spend it on instead. In this symposium, I will focus on how humans solve the trade-off between minimising energy expenditure (i.e., physical effort) and maximising safety (i.e., neutralising the possibility of experiencing aversive electric stimulation). I will present new work on how this important dilemma is solved at the level of subjective value computations (n=164), and the vigour (i.e., intensity) with which we carry out avoidance actions (n=40). Given the stressful nature of threatening contexts, I will additionally discuss how experimental induction of acute stress can bias the “effort-threat” trade-off toward energy expenditure, resulting in a state in which safety is prioritized above all else. Together, these results shed new light on the mental computations that subserve the motivation to carry out vigorous actions under threat.

Thursday, May 23rd 2024 // 2:00pm -3:30pm

*Location: Auditorium 4
Symposium 8*

Cracking the code of the social cognition of face and voice with the CLEESE Python toolbox

Jean-Julien Aucouturier, Paige Tuttosi

Reverse-correlation is a powerful psychophysical method able to uncover what stimulus features are used by observers in perceptual decisions. Although reverse-correlation was traditionally restricted to low-level stimulus dimension (e.g. edge detection in abstract images), recent signal-processing advances have extended the approach to the perception of speech and faces, sparking interest in the affective and social-cognitive sciences. This symposium will introduce CLEESE (Burred et al. 2019), an open-source Python toolbox for generating face and voice reverse-correlation stimuli, and invites presentations from a growing community of research teams in Europe, Canada and China that have begun using it in their own work.

Talk 1 - Jean-Julien Aucouturier & Paige Tuttosi

A quick introduction to reverse correlation with CLEESE, and what's new in V2

Reverse-correlation is a powerful psychophysical method able to uncover what stimulus features are used by observers in perceptual decisions. Although reverse-correlation was traditionally restricted to low-level stimulus dimension (e.g. edge detection in abstract images), recent signal-processing advances have extended the approach to the perception of speech and faces, sparking interest in the affective and social-cognitive sciences. In this short talk, we will introduce an open-source Python toolbox, CLEESE, which radically simplifies the generation of reverse-correlation stimuli for both speech/voice and face perception experiments (Burred et al., 2019). We will demonstrate how to use CLEESE to systematically manipulate the pitch, loudness and rate of multi-linguistic speech, the timbre of voice sounds, as well as the expressive facial features of arbitrary photographs and videos. We will quickly illustrate each of these use cases with published or ongoing work from our own group and elsewhere.

Talk 2 - Fang Liu, Li Wang & Jia Hoong Ong

Mental representations of speech and musical pitch contours show reduced pitch ranges in congenital amusia

Congenital amusia is a neurodevelopmental disorder of pitch processing that causes impairments in music perception but only minor problems with speech perception. To explore what underlies this difference, we examined mental representations of pitch contours across speech and music using reverse-correlation, a novel data-driven method. Twenty-one Mandarin-speaking individuals with amusia and 22 controls

listened to pairs of pitch contours in speech, complex tone, and a well-known melody (containing three notes) generated with the CLEESE toolbox, and judged which of the pair sounded more like a rising tone (for speech and complex tone) or more in tune (for the melody condition). Using reverse-correlation, mental representations of these pitch contours were extracted. Measures of internal noise (variability in perceptual response) and pitch sensitivity (RMS values) were also calculated. Compared to amusics, controls demonstrated a higher pitch range and a steeper slope near the end of the rising tone across speech and complex tone conditions. Mental representations of the melody among amusics also showed a reduced pitch range of notes two and three relative to controls. While the two groups did not differ in internal noise and pitch sensitivity for either speech or complex tone, amusics exhibited higher internal noise and reduced pitch sensitivity than controls for the melody. These findings suggest nuanced differences and similarities between amusics and controls in mental representations of pitch contours across different domains. The different mental representations of pitch contours in different domains may explain why deficits in pitch processing in amusia manifest differently across these domains.

Talk 3 - Ladislav Nalborczyk

The sound of your inner voice: Using reverse correlation to unveil the mental representation of self-produced overt and covert speech

The mental production of speech or “inner speech” is a foundational ability in humans, involved in a plethora of activities, such as reading, planning, or remembering. Inner speech is generally accompanied by a subjective multisensory experience featuring most notably auditory percepts (the “inner voice”). But how does it sound (to you) to produce inner speech? Despite the ubiquity of inner speech, we still lack experimental methods that can be used to systematically describe its phenomenology. I will present preliminary results obtained using reverse correlation –a powerful data-driven method from psychophysics– to characterize the mental representation of both overt and covert self-produced speech. Specifically, using reverse correlation, we can uncover the perceptual filter underlying the recognition of one’s own voice. When this filter is applied to the original voice of the participant, it reveals the mental representation of one’s voice. I will show that overall, the best way to match a participant’s perception of her voice (from a recording of the participant’s actual voice) is to boost all frequencies below 1 kHz and to attenuate all frequencies above 1 kHz, consistent with previous results. This provides a proof of concept that reverse correlation can be used to describe the mental representation of self-produced speech and has important implications for the reeducation of speech and psychiatric disorders, offering the possibility to develop personalized interventions and technologies.

Talk 4 - Alice Karbanova, Kathleen Schneider & Isabell Wartenburger

Interrogative prosody representation in German SVO sentences

The prosodic contour of a sentence plays an important role in conveying syntactic and sentence mode information, with pitch being particularly instrumental in distinguishing between sentence modes such as declarative and interrogative structures (Pell, 2001).

However, a simple distinction between utterance-final rising and falling pitch contours has proven insufficient (Petrone & Niebuhr, 2014). In response, this study employs a reverse-correlation approach (Ponsot et al., 2018) to uncover the underlying mental representation involved in the perceptual decoding of interrogative prosody. Using the voice-processing algorithm CLEESE (Burred et al., 2019), automated pitch variations were applied to a flattened pitch contour of a German SVO sentence, a syntactic structure permitting both declarative and interrogative interpretations. Participants are exposed to 400 pairs of randomly-modulated stimuli and tasked with determining which stimulus more closely resembles an interrogative structure. This methodology enables the identification of the prototypical interrogative pitch contour while maintaining stability in other prosodic markers, such as duration and intensity. The normalised mental prototype of pitch contours indicative of interrogativity is computed by deriving the mean pitch contour for each participant, represented as a 6-point vector corresponding to strategically placed breakpoints throughout the entire sentence. This analytical approach elucidates critical regions and auditory characteristics of the pitch contour that are most pertinent in the prosody perception for sentence mode discrimination. Additionally, our methodology allows for the consideration of individual differences in discriminating between sentence modes.

Talk 5 - Émilie St-Pierre, Annie Bérubé & Caroline Blais

Impact of the environment and individual variables on mental representations of facial expressions of emotions

In the field of emotion perception, theories suggest that an individual's visual representations—referring to how they imagine a facial expression of emotion—are influenced by various factors, including the environment in which they grow up and individual variables such as empathy. Research conducted at the Laboratory of Visual and Social Perception (LPVS) has explored the impact of culture and biases on the mental representations of facial expressions of pain, using the Reverse Correlation technique. This data-driven technique, originating from psychophysics, is commonly employed in vision research to assess individuals' mental representations of facial expressions of emotion. Several findings will be presented, beginning with an exploration of the facial features underlying the decoding of pain expressions (Blais et al., 2019) and the relationship between the ability to infer another's pain and the mental representation of pain facial expression (Lévesque-Lacasse et al., 2023). Additionally, differences between East Asians and Westerners in the mental representations involved in the decoding of pain facial expression intensity will be discussed (Saumure et al., 2023). Furthermore, the application of Reverse Correlation to measure visual representations of pain expression in Black and White faces will be addressed (Gingras et al., 2023). Finally, we will discuss the use of the CLEESE Toolbox to study individual variables, such as empathy and facial expression recognition ability, presenting preliminary results.

Thursday, May 23rd 2024 // 2:00pm -3:30pm

*Location: Auditorium 1
Symposium 9*

Interoception: From the Cradle to the Clinic

Aikaterini Fotopoulou

The brain's ability to sense, perceive and appraise the internal state of the body, i.e. the capacity for interoception, has been linked with both emotion and cognition and it is increasingly implicated in the etiology and symptomatology of many mental health disorders. However, the neural pathways, developmental trajectory of interoceptive abilities and their precise contribution to mental health and wellbeing remain poorly investigated. This symposium brings together early-career researchers and established experts in affective, cognitive and clinical neuroscience to present and discuss cutting-edge methodologies and research findings on interoception with implications for mental health from early infancy to adulthood.

Talk 1 - Micah Allen, Leah Banellis, Malthe Brændholt, Niia Nikolova, Francesca Fardo & Ashley Tyrer

Interoception as a Negative Health Factor: Computational and Neuroscientific Insights into Maladaptive Brain-Body Interactions

Interoception is emerging as a crucial element in mental health. Yet, its measurement and quantification are hampered by significant limitations, particularly in the construct validity and internal reliability of prevailing interoceptive measures. In my presentation, I will introduce innovative approaches to assess interoception across subjective, perceptual, and metacognitive dimensions. Through three distinct studies, we uncover that interoceptive biases, sensitivity, and metacognitive self-beliefs can serve as risk factors, exacerbating participant distress and diminishing mental well-being. This research explores the pivotal role of interoception in mediating isolation-induced distress during the COVID-19 pandemic, its function as a multivariate marker of depression through stomach-brain interactions, and the influence of cardiac self-perceptions on anxiety modulation.

Talk 2 - Manos Tsakiris & Rosie Drysdale

Tracing the relation between interoception and self-awareness in early infancy

Recent studies have tried to empirically test the potential link between exteroceptive and interoceptive awareness of the body. In adulthood there is evidence to suggest that in the absence of accurate interoceptive representations, one's model of self is predominantly exteroceptive. Even though the question of how self-awareness emerges in early infancy has been a central focus of developmental psychology, the question of when and how interoceptive awareness emerges remains unexplored.

Individual differences in how exteroceptive and interoceptive systems modulate bodily self-awareness are particularly relevant from an ontological perspective. We here capitalized on an interoceptive sensitivity task suitable for preverbal infants to study how interoception develops in the first two years of life and how it later relates to the emergence of explicit mirror self-recognition. Adopting a longitudinal approach, we followed 60 infants and their caregivers at 13- and 21- months of age to investigate the trajectory of, and relationship between, interoceptive (cardiac) and exteroceptive perception across infancy (T1) and toddlerhood (T2). The longitudinal data suggest that, as predicted by research on adults, infants who passed the mirror self-recognition task at T2 had lower interoceptive sensitivity at T1. These findings suggest that the dynamic relationship between interoceptive and exteroceptive facets of self-awareness emerges early in life. Future studies should assess whether this relationship remains stable throughout development and importantly how care-infants interactions in early infancy influence the levels of interoceptive and exteroceptive awareness.

Talk 3 - Markus R. Tünte, Stefanie Höhl, Trinh Nguyen, Nadine Pointner, Nina Maier, Manos Tsakiris & Ezgi Kayhan

Infant interoceptive sensitivity – investigating links to affectionate touch and maternal interoception

Interoception and communication of internal bodily states is crucial for early development as infants depend on their primary caregiver for co-regulation. However, there is little empirical research on interoception in infancy. We present studies investigating whether infants are sensitive to their interoceptive signals, and whether maternal interoception is related to affectionate touch and infant interoception. We use a MEGA-analytic approach pooling together data spanning 3-, 6-, 9-, and 18-month-old infants and their primary caregiver. In two preferential looking paradigms we find that infants' cardiac interoceptive sensitivity shows similar characteristics across the 3-, 9-, and 18-month-old samples ($p = .011$), while respiratory interoceptive sensitivity increases towards 18 months ($p = .004$). In 6- and 9-month-old infants we measured affectionate touch by rating videos of a free-play interaction and maternal interoception using a heartbeat counting task. We find exploratory evidence that affectionate touch is negatively related to maternal interoception at 9 months ($p = .04$), but not at 6 months, indicating that mothers with lower interoceptive abilities might regulate their infants through affectionate touch. We do not find that affectionate touch is related to infant interoception. Last, mothers completed additional interoception measures such as a heartbeat detection task. We used a specification curve analysis to illustrate the multiverse of potential analysis choices investigating the relationship between infant and maternal interoception. We find that mean effects differ between measures of interoceptive accuracy and attention ($p < .001$), highlighting the need to differentiate between facets of interoception when investigating maternal interoception.

Talk 4 - Aikaterini Fotopoulou, Michal Tanzer, Caroline Selai, Sam Norton, Thanos Koukoutsakis, Marina Bobou & Alkistis Saramandi

I can control my body even when stressed: An RCT testing the efficacy of biofeedback-assisted psychological intervention for interoceptive awareness.

Disruptions in interoception have emerged as a transdiagnostic pathogenic mechanism for several disorders at the mental-physical health interface, such as eating, functional or somatic symptom disorders. However, the interdisciplinary expertise required to identify and therapeutically target psychophysiological mechanisms has limited the efficacy of related therapeutic endeavours. Following co-design with users, we have developed and tested the efficacy and mechanisms of action of a novel, interdisciplinary (psychophysiological) therapeutic module (InMe) in 100 individuals with low interoception awareness, stratified for subclinical disordered eating or somatisation symptoms. In a two-arm parallel group randomised controlled trial (RCT) we compare the InMe intervention to an active control intervention (imagery training without biofeedback). INME uses cardiac biofeedback during guided respiration exercises to train individuals to down-regulate their own heartrate under different conditions of stress, while also enhancing related metacognitive beliefs. Results showed significantly higher changes of the trials primary measure of interoception at follow-up for INME than for the control intervention ($p < 0.05$). Advanced analyses methods also revealed important mediators and moderators of this effect and the subpopulations likely to benefit. We discuss the potential of further developing and testing this interoception-intervention as an augmented-therapy module for other pharmacological and behavioural interventions targeting disorders at the mental-physical health interface.

Location: Leslokaal 1.2
Symposium 10

Virtual reality as a tool to study threat responses in humans

Matteo Sequestro

Virtual Reality offers a promising avenue for overcoming limitations of classical behavioral tasks. This symposium will focus on the potential of VR in advancing research and understanding of human threat responses. Specifically, talks 1 and 2 will address how VR can help to characterize human escape and avoidance behavior as goal-directed processes instead of hardwired reactions; talk 3 will cover aversive learning in a VR environment mimicking real-life social encounters; talk 4 will present results from a mobile VR-EEG study on naturalistic fear responses; finally, talk 5 will address how Artificial Intelligence can enhance virtual environments to study socio-emotional behavior.

Talk 1 - Dominik Bach

Critical intelligence: investigating human escape in virtual reality.

All animals including humans have to cope with immediate threat to survive and reproduce. Many species employ complex and sophisticated defensive behaviors. Rapid decisions between these actions, without much leeway for cognitive or motor errors, poses a formidable computational problem that is substantially different from the challenges encountered in classical decision-making experiments. However, theories of human defensive behaviour are largely based on extrapolation across species, imagined, or third-person view scenarios. Here, I present the development of a virtual reality to which investigate human escape, in which participants can run for shelter to evade various pre-historically relevant threats. Data from three experiments (N1 = 29, N2 = 30, N3 = 56) challenge a view that escape behaviour is instinctive or hard-wired. Instead, the underlying algorithm appears goal-directed and exhibits planning properties. Escape decisions are based on a detailed identification of threat identity and predicted trajectory, and are pre-planned and dynamically updated as the environment changes. In contrast, information-seeking behaviour might rely on simpler computations. Several aspects of behaviour are predicted by participants' stable personality traits. Finally, we characterise human escape in terms of a typical movement sequence that has no equivalent in cross-species models of defensive behaviour. Taken together, these findings provide novel insights into human escape, and highlight a need for suitable experimental paradigms to investigate the computational mechanisms underlying complex, real-life behaviour in humans.

Talk 2 - Matteo Sequestro

The influence of outcome predictability on social decisions when facing threatening individuals in virtual reality

In order to select the most appropriate course of action, we continuously collect social information from our environment, among which emotional expressions of others are key. Socio-emotional behavior is organized around approach responses to positive stimuli and avoidance of aversive ones. In threatening social contexts, for instance when we are confronted with aggressive individuals, automatic stimulus-driven (SD) processes are commonly considered to be the default determinant of behavior, while goal-directed (GD) processes would only intervene to control such automatic tendencies. However, individuals may not simply react to threatening displays, but also use them to inform more flexible and optimal GD decisions, based on the predicted consequence of each available action. Here we took advantage of VR to develop a new free-choice approach-avoidance task allowing us to manipulate the predictability of expected action-outcome in an ecologically-valid socio-emotional context. I will present three studies (N1 = 60, N2 = 30, N3 = 60) with behavioral, computational and physiological results showing an influence of action-outcome unpredictability over spontaneous avoidance choices, supporting a predominant role of GD processes over SR. Overall, VR seems adapted to unravel the complexity of the neurocognitive mechanisms sustaining human responses to social threat.

Talk 3 - Sabrina Gado

How Do People Adapt to Social Learning Experiences? A Multimodal Social Conditioning Study in Virtual Reality

Adaptive social approach and avoidance behavior is of substantial importance for social functioning and an imbalance in these behavioral tendencies may constitute a risk factor for the etiology and maintenance of mental illness. Hence, learning from social experiences is important to develop adequate social behaviors. To investigate these processes in a naturalistic environment with high ecological validity and experimental control, we developed an immersive virtual environment that combines a social conditioning procedure with a social approach-avoidance test. In this environment, we conducted two experiments to investigate whether participants differing in trait social anxiety develop adaptive approach and avoidance tendencies towards differently conditioned virtual agents on a behavioral level (whole-body movement, interpersonal distance), regarding active exploration (gaze behavior) as well as on a subjective level (subjectively perceived likeability, fear, and anger). Furthermore, autonomic responses (pupillary, electrodermal and cardiovascular responses) were continuously measured and compared between conditions. Overall, we observed significant effects of the social conditioning procedure on participants' exploration behavior, i.e., the interpersonal distance and spontaneous fixations towards the virtual agents, and on participants' subjective ratings of perceived likeability, fear, and anger. While there were also differences in autonomic responses directly following the social encounters, we did not find any long-term adaptations that persisted during the social approach-avoidance test. Trait social anxiety was associated with higher fear ratings and modulated the adaptations of interpersonal distance. These findings demonstrate the potential of immersive virtual reality environments to examine social learning processes in conditions that resemble important characteristics of real-life social encounters.

Talk 4 – Joanna Kisker

Complex fear responses in Virtual Reality: A mobile EEG study

For the sake of experimental control, stimuli used in laboratory settings are oftentimes less complex than in real-life experiences. For example, psychological science conventionally makes use of stimulus presentation on a computer screen to elicit, e. g., fear responses. The corresponding behavioral responses are operationalized through substitutional responses like keystroke. Overcoming these limitations, immersive virtual reality (VR) enables realistic behavioral responses. To underpin this claim, we focused on the behavioral and affective responses to a frightful mixed reality environment while measuring brain activity by means of a mobile EEG. Participants were asked to explore either a frightful or a neutral VR cave, complemented by a physical replica. This setup allowed for full-body responses, and most importantly, to physically walk through the cave. Remarkably, participants strongly adapted their behavior to their virtual surroundings: Whereas participants explored the non-emotional cave rather casually, participants in the frightful cave exhibited a broad spectrum of behavioral reactions, like hiding or fleeing. Surprisingly, these strong behavioral reactions could hardly be reconciled with established electrophysiological markers. However, as the VR environment facilitated non-mediated and realistic emotional and behavioral responses, our results demonstrate VR's high potential to increase the ecological validity of scientific findings.

Talk 5 - Beatrice de Gelder

Exploring the Augmentation of Social Reality through AI: Emotion, Communication, and Non-Verbal Language in Virtual Environments

Emotional communication, a fundamental pillar of social interaction, is now facilitated by AI algorithms capable of recognizing and responding to emotional cues in real-time. These algorithms enable virtual avatars to simulate authentic emotional experiences, mirroring users' sentiments and amplifying empathetic engagement. Virtual reality, propelled by AI, acts as a canvas where users craft their ideal self-representations, fostering self-discovery and empowerment. Avatars, alter egos or other virtual extensions of users' identities, enable creative self-expression with or without offering a safeguard against social anxieties. This metamorphosis of self-presentation enhances user comfort, thus catalyzing uninhibited social engagement. Non-verbal language, a cornerstone of human expression, is mobilized through AI-enabled avatars capable of deciphering and emulating subtle gestures, facial expressions, and body language. This enables users to convey emotions and intentions, mimicking real-life interactions and deepening interpersonal connections in virtual settings. In addition, natural language processing algorithms empower avatars to engage in meaningful conversations, transcending language barriers and accommodating diverse cultural contexts. This talk will discuss findings obtained in five studies combining VR with methods leveraging fMRI, EEG and physiology.

Location: Leslokaal 1.3
Symposium 11

The crossroads of conflict: Modulating decision-making, inhibitory control, and their neural signatures in social, moral, and intertemporal scenarios

Damiano Terenzi, Anne Saulin, Giorgia Ponsi, Gabriele Fusco

Decision-making requires to compute costs and benefits of competing alternatives. Choosing among options that involve relevant individual, social or moral consequences may generate decisional conflict. Further, optimal decision-making requires inhibitory control, the ability to dynamically modify or cancel actions that are no longer advantageous for the individual. This symposium will feature diverse perspectives aimed at understanding how decision-making and inhibitory control can be manipulated as a function of social context, social motivation, dopaminergic medication, and non-invasive brain stimulation. The proposed contributions will focus on both neurotypical and clinical (individuals with cocaine use disorder and with Parkinson's Disease) populations.

Talk 1 - Damiano Terenzi

Social context and drug cues modulate inhibitory control in cocaine addiction: involvement of the STN evidenced through fMRI

Addictions often develop in a social context, although the influence of social factors did not receive much attention in the neuroscience of addiction. Recent animal studies suggest that peer presence can reduce cocaine intake, an influence potentially mediated, among others, by the subthalamic nucleus (STN). However, there is to date no neurobiological study investigating this mediation in humans. This study investigated the impact of social context and drug cues on brain correlates of inhibitory control in individuals with and without cocaine use disorder (CUD) using functional Magnetic Resonance Imaging (fMRI). Seventeen CUD participants and 17 healthy controls (HC) performed a novel fMRI "Social" Stop-Signal task (SSST) in the presence or absence of an observer while being exposed to cocaine-related (vs. neutral) cues eliciting craving in drug users. The results showed that CUD participants, while slower at stopping with neutral cues, recovered control level stopping abilities with cocaine cues, while HC did not show any difference. During cocaine-related inhibitory control (vs. neutral cues), the right STN and the bilateral orbitofrontal cortex (OFC) exhibited activity modulated in CUD but not in HC. This brain activity was reduced in the presence of an observer. These findings highlight the impact of social context and drug cues on inhibitory control in CUD and the mediation of these effects by the right STN and bilateral OFC, emphasizing the importance of considering the social context in addiction research. They also comfort the STN as a potential addiction treatment target.

Talk 2 - Anne Saulin

How social motivations modulate the (pro)social decision process

Every day, we make decisions that affect both ourselves and others. In such scenarios, we can often choose between maximizing our own outcome (egoistic option) and maximizing the other's benefit (prosocial option). Here, we present three studies in which we applied drift-diffusion modelling (DDM) and fMRI to investigate how different motivations to decide prosocially shape such social decision processes in the laboratory and in an online setting. In study 1, we show how empathy (sharing another's affect) and reciprocity (returning a favor) together and separately influence a person's predecisional bias towards choosing prosocially. We observed that individual changes in this bias were linked to changes in individual dorso-striatal activation. Study 2 examines to what extent additionally paying people to choose prosocially alters behavioral and neural correlates of empathy-motivated decisions. Results showed that monetary incentives increase the efficiency of the social decision process (indicated by a larger drift-rate parameter of the DDM), which is linked to neural changes in the anterior insula. In study 3, we further corroborate this behavioral effect and observe that paying participants for fair or unfair decisions specifically modulates the drift-rate parameter. Together, these studies demonstrate that different motivations to make prosocial decisions alter specific aspects of the (pro)social decision process and related neural activation.

Talk 3 - Giorgia Ponsi (Chair)

Dopaminergic modulation of moral decision-making and sense of agency in Parkinson's Disease

Previous studies found that Parkinson's Disease (PD) patients generally refrain from immoral behavior and show increased Sense of Agency (SoA) when ON vs. OFF dopaminergic medication, suggesting that dopamine may influence moral behavior through a SoA enhancement. We tested 24 healthy controls (HC) and 24 PD patients, on (PD-ON) and off (PD-OFF) dopaminergic medication. Moral decision-making was measured through the Temptation to Lie Card Game (TLCG), a task measuring spontaneous deception in a social context. SoA was measured with the Sense of Agency for Goal Achievement and Movement Execution (SoA-Game), a task in which participants perform goal-directed actions while viewing a virtual hand performing the same or a different action, simultaneous or delayed, and provide synchrony judgments (SJs) between executed and observed action (SoA measure). In the SoA-Game, when participants observed a congruent movement and the goal was missed (M+G-condition), SJs were higher in ON vs. OFF medication. SJs were also higher in the M+G-condition for HC compared to PD-OFF, but not PD-ON. Hence, SoA seems to be increased by dopaminergic medication. Individual SJs (M+G-condition) were employed as predictors in the moral decision-making analyses. When participants faced an unfavourable outcome in the TLCG, increased SoA predicted a reduction in self-serving deception in PD-ON but not in PD-OFF. The same pattern was found in PD-ON compared to HC. Our results suggest that dopamine may decrease dishonesty by enhancing SoA, and support theories proposing a role for dopamine in social behavior regulation and a link between SoA and morality.

Talk 4 - Gabriele Fusco (Co-Chair)

Modulating preferences during intertemporal choices through exogenous midfrontal transcranial alternating current stimulation

Decision conflicts may arise when the costs and benefits of choices are evaluated as a function of outcomes predicted along a temporal dimension. Electrophysiology studies suggest that during performance monitoring a typical oscillatory activity in the theta rhythm, named midfrontal theta, may index conflict processing and resolution. In the present within-subject, sham controlled, cross-over preregistered study, we delivered online midfrontal transcranial Alternating Current Stimulation (tACS) to modulate electrocortical activity during intertemporal decisions. Participants were invited to select choice preference between economic offers at three different intermixed levels of conflict (i.e., low, medium, high) while receiving either theta-, gamma-, or sham tACS in separate blocks and sessions. At the end of each stimulation block, a Letter-Flanker task was also administered to measure behavioural aftereffects. We hypothesized that theta-tACS would have acted on the performance monitoring system inducing behavioural changes (i.e., faster decisions and more impulsive choices) in high conflicting trials, rather than gamma- and sham-tACS. Results partially confirmed our predictions. Unexpectedly, both theta- and gamma-driven neuromodulation speeded-up decisions compared to sham. However, exploratory analyses revealed that such an effect was stronger in the high-conflict decisions during theta-tACS. These findings were independent from the influence of the sensations induced by the electrical stimulation. Moreover, further analyses highlighted a significant association during theta-tACS between the selection of immediate offers in high-conflict trials and attentional impulsiveness, suggesting that individual factors may account for the tACS effects during intertemporal decisions. Finally, we did not capture long-lasting behavioural changes following tACS in the Flanker task.

Thursday, May 23rd 2024 // 2:00pm -3:30pm

*Location: Leslokaal 3.2
Symposium 12*

From self-priority to mentalising about others: New insights in experimental, clinical, psychopharmacological and neuroimaging research.

Annabel Nijhof, Emma Alen, Alix Bigot, Henryk Bukowski, Yulong Huang, Lara Bardi, Roeljan Wiersema (discussant)

One strand of research has demonstrated that stimuli associated with the Self benefit from a performance advantage and the degree of self-prioritisation has regularly been linked to positive outcomes related to the good development of the Self. Another strand of research, however, has always considered self-focus or egocentrism as an obstacle to understanding others' thoughts, emotions, and behaviours. This symposium aims to integrate these two strands of research and revisit our respective claims about the meaning and outcomes of self-prioritisation across experimental, clinical, psychopharmacological and neuroimaging research.

Talk 1 Annabel Nijhof

Neural correlates of self- and other-related processing in adults with and without autism

Humans show enhanced (neural) responses to self-related stimuli, such as their own face or name. These enhanced responses are thought to be crucial for social functioning, and have been found to be diminished in individuals with autism. However, neural responses to self-related stimuli have rarely been investigated across different stimulus types. Further, it is still being debated precisely which aspects of self-related processing are altered in autism. Therefore, we aimed to investigate the neural processes underlying own and other face and name processing across two studies, one in a large neurotypical sample, one in adults with and without autism. Participants passively viewed six runs of face images, and six of names, in three categories (Self, Close Other, Stranger), in a 3T MRI scanner. Whole-brain analyses for both studies revealed stronger activation for familiar faces and names than for a stranger's face/name in a number of visual areas, but also in areas associated with self-related processing such as the intraparietal sulcus and ACC. Self-specific enhancement was found in similar areas, but less consistently. In the second study, no group differences between individuals with and without autism were found. In a next analysis step, we will perform (more sensitive) representational similarity analyses to investigate group differences in activation patterns for self- and other-related stimuli, within and across stimulus type. Based on the whole-brain analysis, the studies suggest that self- and close-other related processing rely on stimulus-specific as well as more abstract neural mechanisms.

Talk 2 Henryk Bukowski

The close other first! Comparison of performance at accessing, generating, and remembering self-knowledge and knowledge about a close other

Do we store, access, and build knowledge about ourselves better than knowledge about a close other? Answering this question faces the psychometric challenge that self-knowledge has been operationalized in numerous ways. To address this issue, we developed a novel internet-based battery of tests, the Battery of Other- and Self-Knowledge (BOSK), designed to assess key elements of the cognitive architecture of self-knowledge as delineated by the Self-Memory System model. The BOSK allows to compare performance at handling self-knowledge versus knowledge of a close other on source and recognition memory, episodic imagination of future events, fluency for semantic person descriptions of present and future times, and descriptions of the multiple selves of the self-concept. The results revealed self-reference led to performance advantages for episodic imagination, self-concept descriptions, and a novel 'cued' source memory test (performance helped by established person knowledge). On the other hand, source and recognition memory was better when stimuli referred to the close other, and no difference was observed for semantic fluency. Closeness and mutual knowledge with the close other predicted better performance for the closer other than for self-knowledge. The co-existence of self-advantages and close-other advantages questions the domain-generalizability and stability of the self-reference effect and highlights the necessity to adopt a multi-measure method to assess self-knowledge and knowledge of others.

Talk 3 Alex Bigot

What does self-priority mean? Behavioural correlates of self-priority in perspective taking across 1500 individuals

Research conducted on self-related processes tends to highlight an association with positive consequences.. However, too much focus on the self is also associated with egocentricity, with little regard for others. What if information about the self and the others both need to be represented? The ability to understand others' mental states is almost exclusively measured by performance-based tasks that do not enable its comparison with the understanding of self-experienced mental states. The level-1 visual perspective-taking task (Samson et al., 2010) allows to assess the extent to which participants performed better at judging their own visual perspective than at judging the perspective of another person (Bukowski & Samson, 2017). This tendency refers to the Self-other priority dimension (SOP), and is interpreted as reflecting the attentional priority one mobilizes for information pertaining from the self-perspective in comparison to the information pertaining from the other person's perspective. Through retrospective analyses of data collected in laboratory and via internet across more than 1500 individuals, we examine the behavioural correlates of self-priority and priority for the other perspective with empathic tendencies, narcissism, gender, and age. Whether self-priority relates to positive or negative outcomes in the context of perspective taking will be discussed.

Talk 4 Yulong Huang & Lara Bardi

Oxytocin-induced modulation of explicit and implicit perspective-taking

Visual perspective taking (VPT) is a core process of social cognition, enabling individuals to understand their environment from diverse viewpoints. Explicit VPT, involves conscious cognitive effort and intentional consideration of perspectives, while implicit VPT is characterized by spontaneous/implicit perspective consideration. Oxytocin (OXT), a neuropeptide recognized for its pivotal role in social bonding and empathic processes, has garnered considerable attention as a potential modulator of social behaviour. Although OXT has been shown to modulate self-other distinction, its specific impact on both explicit and implicit VPT remains poorly explored. Here, using a double-blind, placebo-controlled Mixed design, eighty healthy female participants (Oxytocin=39, Placebo=41) took part in both an explicit and an implicit VPT task. Participants were asked whether an object was located to the right or to the left from their own point of view (in the presence of an avatar having the same or a different point of view on the object, implicit VPT) or from the perspective of the avatar (explicit VPT). Results revealed that intranasal oxytocin (IN-OXT) modulated both explicit and implicit perspective-taking. IN-OXT, in comparison to placebo, significantly reduced accuracy in explicit VPT. Conversely, it enhanced implicit VPT in the presence of an avatar, and not in the presence of an inanimate object (control condition). This investigation sheds light on the effects of OXT on distinct facets of visual perspective-taking, offering valuable insights into its role in shaping human social interaction.



May 23rd – 4:00pm – 5:30pm

ORAL TALKS

Location: Auditorium 2

Oral talks 1: Social interactions

Oxytocin and trust game behavior: a registered large-scale replication

Charlotte Kroll

The neuropeptide oxytocin (OXT) is thought to modulate important aspects of prosocial behavior. In a seminal paper, Kosfeld et al. (2005) reported that intranasally administered OXT modulated trusting behavior in an economic trust game. Several attempts to conceptually replicate these findings yielded mixed results, which may be partly due to small sample sizes that can reduce the ability to detect, or reject, meaningful effects. Here, we propose to perform a large-scale replication (N=220) of Kosfeld et al. (2005) in the format of a registered report. Moreover, we plan to conduct the largest-ever pooled analysis by merging our data with data from a previous replication by Declerck et al. (2020). Our manuscript has received Stage 1 in-principle acceptance by the Peer Community In Registered Reports (PCI-RR; <https://osf.io/h5gdp>). At ESCAN, an interim analysis on the main effect of OXT versus placebo on trust game behavior will be presented. We expect our study to contribute to a more refined understanding of OXT's involvement in human social behavior and to offer a more realistic perspective on the effect sizes that can be expected when using intranasal OXT to modulate human prosocial behavior.

Location: Auditorium 2

Oral talks 1: Social interactions

Observation of Social and Non-Social Interactions in Dogs and Humans: Results from fMRI and Eyetracking

C.-N. Alexandrina Guran

To investigate the origins of social cognition, we need to look beyond the human species. Investigations within primates constrain us to a linear understanding of evolution. Dogs have emerged as an alternative animal model because our last common ancestor with them dates back 95-100 million years. They have advanced socio-cognitive skills, even when discounting recent domestication effects, not present in many other mammals, suggestive of convergent rather than linear evolution. Moreover, they can be trained to perform awake and unrestrained functional magnetic resonance imaging. To better understand convergent evolution of social cognition, we conducted fMRI in 36 healthy pet dogs and 42 human adults, investigating neural processing of social interactions with largely identical scanning and experimental parameters. Dogs and humans viewed social interaction videos between dog or human agents, as well as non-social agent-object interactions. Dogs show specific activation patterns for social compared to non-social stimulus observations, in particular higher involvement of rostral sylvian, suprasylvian and ectosylvian gyri bilaterally, which have been linked to facets of action and agent processing. In terms of eyetracking, dogs showed longer visual engagement with social than non-social stimuli, indicative of a stronger relevance and salience of social than agent-object interactions for dogs. A higher number of saccades in the social interaction videos, in particular in the dog-dog interactions, can be linked to turn-taking, or dialectic, processing of social interactions.

Our findings showcase communal and distinct aspects of social interaction processing across the mammalian lineage, increasing our understanding of how different brains produce similar behaviors.

Location: Auditorium 2

Oral talks 1: Social interactions

Causal social interaction research with voice and face transformations

Pablo Arias Sarah, Guillaume Denis, Jean-Julien Aucouturier, Rachael E. Jack, Philippe G. Schyns, Petter Johansson, Lars Hall

One of the current limitations in social interaction research is being able to perform causal inference in free social interactions. This is because interactions are influenced by a plethora of covarying factors, such as each person's personality, culture, mood, emotions, affect and intent. To be able to make causal inferences in free social interactions, researchers need a tool which enables them to manipulate specific factors during the interactions without participants' awareness. Recent advances in voice and face transformations make this possible. In the current talk, I will illustrate the potential of such voice/face transformation filters for cognitive science research. To do so, I will present an experiment where we asked single heterosexual participants to participate in a series of video-conference speed dating interactions, while we artificially aligned or misaligned their facial expressions with smile manipulation algorithms. Even though participants remained totally unaware that their faces were being manipulated, aligned scenarios causally enhanced romantic attraction compared to misaligned scenarios. The manipulations also affected how participants synchronised with each other, and their vocal behaviour.

I will finish presenting our new experimental video-conference platform DuckSoup which we developed to perform these experiments online, and for which we will be hosting a tutorial during the conference. In short, Ducksoup enables researchers to parametrically transform participants' voice and face in real-time during online social interactions. DuckSoup can therefore enable researchers to study how specific social signals (e.g., smiles) causally trigger physiological and social behaviors in naturalistic settings.

Location: Auditorium 2

Oral talks 1: Social interactions

Assessing the real-time effects of deceptive interaction on motor resonance: a dual-person Transcranial Magnetic Stimulation study

Alessandra Finisguerra, Marco Zanon, Giulia D'Argenio, Sonia Betti, Cosimo Urgesi

Deceptive intentions in others' actions modulate the onlooker's motor system, independently from the mapping of kinematic adaptations required to deceive the other. Previous studies investigated motor responses to others' actions using passive observation of videos. However, video observation paradigms, albeit allowing controlled settings, can only remotely account for the complexity embedded in real social interactions. Here, we used dual-person, single-pulse Transcranial Magnetic Stimulation to measure cortico-spinal excitability (CSE) from hand and forearm muscles in pairs of participants actively engaged in real interactions. Namely, a misleader partner lifted to offer a heavy or a light cube with a deceptive or genuine intention, while a misled partner received to lift and place the cube trying to resist to deception. From both partners, we measured electromyographic (EMG) activation while they executed the lifting movements and CSE while they observed the lifting movement executed by the other. Results showed that the CSE of the misleader's hand muscle was higher during the observation of the misled partner receiving an object offered with a deceptive vs. genuine intention. Differently, CSE was reduced in the misled partner during observation of the misleader acting with a deceptive intent. Importantly, with respect to genuine actions, deceptive actions affected the synchronization between onlooker's CSE and actor's EMG activation, suggesting that interacting with a deceptive intention tunes together the motor representations of the two partners.

Location: Auditorium 2

Oral talks 1: Social interactions

Brains on Playfulness: playful interactions enhance cognition in older ages

Yulia Golland, Shoshi Keisari, Boaz Ben-David

Engaging in social interactions is vital for human development and plays a pivotal role in mental health and cognitive resilience over the life-course. Notably, not all interactions are equal: while some can be engaging, enhancing curiosity and aliveness, others are mundane and have a lesser impact. Here we tap into playful interactions (PI), a part and parcel of creative arts, during which individuals co-create an imaginative world together. Taking a significant step further from previous research, we examine the effects of PI on cognition in older adults.

Across three studies, 150 individuals aged 75 and older engaged in verbal and nonverbal PI, unfolding in person or on Zoom. Results showed that participants exhibited a significant improvement in cognitive performance after engaging in a short, playful interaction as compared with a more familiar one. These positive effects on cognition were corroborated by increases in social connection, positive mood, and arousal. These findings suggest that PI holds a unique potential for older ages, serving as a possible antidote to cognitive decline and answering a deep human need for connection.

Lastly, I will present preliminary findings from an ongoing physiological study of PI and propose a putative neurobiological path underlying its beneficial effects. Accordingly, high levels of uncertainty unfolding through reciprocal and affirmative social exchanges trigger a co-activation of the noradrenergic cortical arousal system and the oxytocinergic affiliation system, giving rise to the “sweet spot” of optimal arousal, enhanced cognitive performance, and warm feelings of connectedness.

Location: Auditorium 4

Oral talks 2: Mentalizing

Agreeableness modulates mental state decoding: Electrophysiological evidence

Elisabetta Pisanu

Agreeableness is one of the five personality traits which is associated with Theory of Mind (ToM) abilities. One of the critical processes involved in ToM is the decoding of emotional cues. In the present study, we investigated whether this process is modulated by agreeableness using electroencephalography (EEG) while taking into account task complexity and sex differences that are expected to moderate the relationship between emotional decoding and agreeableness. This approach allowed us to identify at which stage of the neural processing agreeableness kicks in, in order to distinguish the impact on early, perceptual processes from slower, inferential processing. Sixty-two young adults were selected from a larger sample screened for agreeableness to increase in-sample variance. They underwent EEG recording while performing two experimental tasks: the Reading the Mind in the Eyes task, requiring the decoding of complex mental states from eye expressions, and the Biological (e)motion task, involving the perception of basic emotional actions through point-light body stimuli. ERP results showed a significant correlation between agreeableness and the contrast for emotional and non-emotional trials in a late time window only during the RME task. Specifically, higher levels of agreeableness were associated with a deeper neural processing of emotional versus non-emotional trials within the whole and male samples. In contrast, the modulation in females was negligible. The source analysis highlighted that this ERP-agreeableness association engages the ventro-medial prefrontal cortex. Our findings expand previous research on personality and social processing and confirm that sex modulates this relationship.

Thursday, May 23rd 2024 // 4:00pm - 5:30pm

Location: Auditorium 4

Oral talks 2: Mentalizing

The Bodily Maps of Emotion Test (BMET): a tool to assess affective Theory of Mind

Erika Bucci

Affective theory of mind (AToM) is the ability to understand others' emotions and is operationalized as the performance in pairing facial expressions with mental states (Baron-Cohen et al., 2001). In natural settings, however, others' feelings are construed from the entire body's response. Building upon this, we developed the "Bodily Maps of Emotion" test (BMET), a tool measuring AToM as the ability to infer mental states from bodily reactions.

Participants (n=250, 151F, 27±6yrs) marked on a human silhouette the regions they typically feel (de)activated when experiencing 65 distinct emotions. Individual maps were then averaged to obtain bodily maps of emotion (Nummenmaa et al., 2013). In an independent sample (n=286, 176F, 30±10yrs), we measured personality (BFI-2), interoceptive awareness (MAIA), alexithymia (TAS), and the accuracy in pairing bodily maps with emotions in a 5-AFC task.

On average, participants' accuracy at the BMET is 44%. High and low performers (95th 5th percentile) respectively associate 60% and 28% of the emotions with their relative maps. Concerning item facility, pleasure and embarrassment are identified from bodily maps by ~70% of people, contempt and egotism only by ~18%. BMET relates negatively to the TAS externally-oriented thinking subscale (pFDR=0.03), suggesting that the less individuals pay attention to their inner feelings, the worse they perform at our AToM task. There are no relationships between BMET and personality, interoception, age, or gender.

In the future, BMET could serve to investigate AToM with a focus on bodily sensations in patients with social impairments (bvFTD, ASD).

Location: Auditorium 4

Oral talks 2: Mentalizing

The impact of incidental anxiety on the neural signature of mentalizing

Jan Engelmann

While the effects of anxiety on various cognitive processes, including memory, attention, and learning, have been relatively well documented, the neurobiological effects of anxiety on social cognitive processes remain largely unknown. We address this gap using threat-of-shock to induce incidental anxiety while participants performed two false-belief tasks, a standard and an economic-games version. During belief formation and belief inferences, regions in a canonical social cognition network showed activation reflecting mentalizing, including the temporoparietal junction (TPJ), precuneus, and dorsomedial prefrontal cortex (dmPFC). At the same time, we found threat-related suppression of social cognition regions during belief inferences. A conjunction analysis confirmed that a network of regions was simultaneously engaged during mentalizing and suppressed by anxiety: bilateral TPJ, bilateral IFG, and putamen. We examined how threat impacted the connectivity between these seed regions and its targets. During belief formation, we found that threat suppressed the connectivity between the precuneus and two key mentalizing nodes, the dmPFC and right TPJ. Moreover, during belief inferences threat specifically suppressed belief-based connectivity between putamen and its targets in IPS and dlPFC. Dispositional distress significantly modulated threat-related suppression of connectivity between the left TPJ and left IPS. Our results indicate that social cognitive processes rely on support from other large-scale networks, such as the reward and attentional systems, and that these network interactions are disrupted under incidental and dispositional anxiety.

Location: Auditorium 4

Oral talks 2: Mentalizing

Investigating the role of thinking other's minds on looking behaviour and aesthetic judgements

Ionela Bara, Emily Cross, Lorin Schöni

An important prerequisite for understanding and appreciating art is believed to be reasoning about the mental states of others, such as the artist's intention or the fictional characters portrayed. Thinking about others' mental states is an essential ability for general social cognition – in guiding social interactions, preparing, and predicting behaviours. However, little is known about the impact of thinking about others' minds on looking behaviour and aesthetic judgements. Given the essential role of aesthetics in guiding how we evaluate objects, people, and experiences in our environment, in this pre-registered study we investigated the extent to which thinking about other's minds impacts the looking behaviour and aesthetic judgements of artworks. We recorded the eye movements of 50 participants and ratings of liking, understanding and emotions of Impressionist artworks depicting people and landscapes from self-perspective and other-perspective. Using a multi-level Bayesian modelling approach, we found that adopting other people's perspectives rather than self-perspective led to greater fixation duration and count for artworks depicting people rather than landscape while making aesthetic judgements. These findings suggest that thinking of other people's minds impacts gaze behaviour and aesthetic judgements. Overall, this study contributes to a deeper understanding of the ability to attribute mental states to oneself and others, and how such mentalizing states impact looking behaviour and aesthetic experience of art.

Location: Auditorium 4

Oral talks 2: Mentalizing

Observer-agent kinematic similarity modulates neural activity in regions of the action observation network

Bianca Schuster, Yuto Kurihara, Ayaka Tsuchiya, Kento Nakagawa, Yuko Okamoto, Rieko Osu

Body movement conveys important information about agents' internal states, such as their emotions or intentions. But how do humans use body movement cues to understand others? A growing body of behavioural and neuroimaging work suggests that we map observed actions onto our own motor system to successfully interpret others' movements, and that movement similarity between an agent and observer facilitates accurate inferences about the agent's internal state. A network of frontal, parietal and occipitotemporal regions, termed the action-observation network (AON), is presumed to subserve this coupling between action observation and -execution. However, it is currently unclear how exactly the AON supports action understanding and how movement similarity modulates putative motor mapping processes.

We used a well-established Theory of Mind task and fMRI to investigate whether regional blood flow in AON regions during mentalising is modulated by movement similarity. 31 participants first created their own animations of interacting triangles, depicting three mental state words, while their finger movements were recorded. Subsequently, individuals viewed animations created by an independent sample, which varied in the degree of kinematic similarity between animator and observer, while undergoing fMRI scanning. ROI analysis revealed a parametric decrease of neural activity within the right angular gyrus with increasing movement similarity. FWE-corrected whole-brain analyses additionally revealed a decrease in bilateral insular activation along with movement similarity. Results are in support of a predictive processing view of action understanding, wherein observers invert a generative model linking their own actions to affective outcomes to infer the internal states underlying others' action.

Location: Auditorium 1
Oral talks 3: Emotion & Attention

The Impact of Naltrexone on Positive Affect and Attentional Scope

Henk van Steenbergen

Previous research has demonstrated that positive affect either narrows or broadens attention, depending on whether it is induced before or after the main task goal is achieved. However, the specific neurochemical processes involved in this modulation are unknown. We aimed to shed light on this topic by investigating how naltrexone, an opioid antagonist, may impact the effects of positive affect on attentional breadth. In this pre-registered study, we recruited forty volunteers to participate in a placebo-controlled experiment consisting of two sessions. During each session, participants were randomly assigned to receive either naltrexone or a placebo before engaging in a Navon Letters task, which had previously been used to explore the effects of pre-goal and post-goal positive affect on attentional scope. In each trial, a visual cue indicated the potential monetary reward, followed by a pre-goal Navon stimulus. Subsequently, participants performed a lexical decision task. Afterwards, they received feedback regarding the amount of money earned, followed by a post-goal Navon stimulus. Our results revealed that pre-goal positive affect narrowed attention, but contrary to previous findings, post-goal positive affect did not broaden attention. Furthermore, our pharmacological manipulation did not appear to influence these effects. These findings suggest that pre-goal positive emotions indeed narrow attention, while the broadening effect of post-goal positive emotions may be more challenging to observe. Additionally, our results indicate that these effects are unlikely to be regulated by the endogenous opioid system. Future studies are necessary to uncover the neurochemical mechanisms underlying the affective modulation of attentional scope.

Location: Auditorium 1
Oral talks 3: Emotion & Attention

Exploring the Role of Valence in Conscious Perception: Insights from Similarity Judgments and Deep Learning Models

Inès Mentec

Recent theories claim that valence plays an important role in conscious perception (Cleeremans & Tallon-Baudry, 2022, Barrett & Bar, 2009). Inspired by these theories, we tested how valence judgments are related to similarity judgments and whether they correlate with different stages of processing in deep neural networks (DNNs). More specifically, we focused on micro-valence, i.e. valence of presumably neutral everyday objects.

Forty-seven participants provided similarity judgments for 120 images of everyday objects using the odd-one-out task. Using the birthday task (Lebrecht et al., 2012), we also collected affective judgments for the same 120 images. Finally, for the same images, we extracted activations from the layers of DNNs trained to classify objects.

Leveraging representation similarity analysis, we first compared affective and similarity judgements. We found that affective processing was correlated with similarity processing, indicating that valence contributes to similarity judgments. This result was confirmed by multidimensional scaling analyses that highlighted the role of valence in the similarity space.

DNN analysis showed that perceptual features of the stimuli contributed to both valence and similarity processing. Most importantly, valence processing correlated with activations in the first DNN layers, indicating that low-level visual features take part in the computation of valence in everyday object perception.

These results indicate that valence computation may be present already in early visual processing. They also show that valence is involved in similarity judgments, suggesting a link between affective experience and cognitive tasks, corroborating recent claims for the functional role of affective conscious experience (Cleeremans & Tallon-Baudry, 2022).

Location: Auditorium 1
Oral talks 3: Emotion & Attention

Attention in neural networks for cognitive stability and flexibility

Xiaoyu Zhang, Mehdi Senoussi, Tom Verguts

Making your way in today's complex world requires two apparently contradictory abilities: One must flexibly adapt to novel tasks, but at the same time one must also retain the ability to solve earlier tasks. However, as tools to study such flexibility, conventional neural networks are notoriously plagued by severe problems. First, they require a lot of training for each new task (little transfer between tasks that share components); and second, they suffer from catastrophic inference, so they forget older information. To address these problems, we propose that attention can support neural networks. Attention is a key concept in psychology and neuroscience, and has recently also become influential in AI (in the context of transformers). Yet, the attention in transformers is cognitively implausible. Here, we seek to develop neural networks that learn to attend, but in a manner inspired by cognitive neuroscience. We investigate how the resulting model implements cognitive flexibility, and in particular generalization to (partially) novel tasks, and robustness in the face of potential interference. We fit the model to two well-established cognitive tasks: the modularity task and C-PRO task (Ito et al., 2022), and compare it to traditional neural networks. Our findings reveal that neural networks equipped with multiplicative attentional gating exhibit significantly improved generalization and robustness compared to traditional networks. These insights hold meaningful implications for how attention is implemented in biological networks, and how it supports cognitive flexibility demonstrated by humans in adapting to various environments and tasks.

Location: Auditorium 1
Oral talks 3: Emotion & Attention

The hierarchical processing of emotions represented in complex social scenes

Elahe Yargholi, Laurent Mertens, Joost Vennekens, Jan Van den Stock, Hans Op de Beeck

Humans can evaluate the emotional meaning of complex social interactions in real-life settings, but it is unclear how this assessment is achieved. Previous research has suggested that the emotional content of images is represented in visual areas of the brain and captured by basic artificial intelligence (AI) models. However, this research included simple images, e.g. a flower landscape, and these findings may not apply to more complex scenes involving social interactions. To answer this question, we prepared stimuli that depict social human interactions in emotionally loaded scene contexts, e.g. funerals. Across the full set, the valence of the people in the scene was partially dissociated from the valence of the scene context, achieved by including incongruent images, e.g. people laughing at a funeral. Human participants could process various properties of these stimuli. Neuroimaging (fMRI) and AI responses showed that (i) visual areas represent the emotional valence of the scene context, and (ii) existing models for image valence processing rely mostly on the valence of the scene context. Yet, they both fail to capture the emotional valence of the social interactions. Neural responses selective to the valence of people in the scene are only generalized across images in the association cortex. Advanced multi-modal AI models that integrate text and vision are also able to partially capture the valence of the social interactions on top of the valence of the scene context. Our findings indicate that understanding complex social interactions requires advanced cognitive processes that go beyond the coding of visual features.

Location: Auditorium 1
Oral talks 3: Emotion & Attention

Disentangling the mechanisms of visual awareness and attention with the Attention Network Task - a behavioral and ERP study

Michał Wierzchoń, Kinga Ciupińska, Wiktoria Orłowska, Aleksander Zębrowski, Laura Łepa, Marcin Koculak, Michał Bola

While traditional views align with the Global Neuronal Workspace Theory, which suggests that visual awareness and attention seem tightly connected, theories emphasizing the phenomenal aspect propose that attention and awareness are distinct and dissociable processes. The present study addressed this issue and employed the Posner model and the version of Attention Network Task (ANT) to investigate the impact of alerting and orienting attention on perceptual awareness. In this study (N = 96), we focused on both behavioural processes related to awareness and the neural correlates of consciousness (NCC), primarily the early visual awareness negativity (VAN) and the late positivity (LP) components. Results showed that both alerting and orienting networks contribute to recognizing visual stimuli at a threshold level. The ERP analysis suggests that the VAN may operate independently of attention, while both attention networks influence the LP amplitude. Surprisingly, LP modulation appears to be driven by expectation rather than attention. Summing up, our study reveals a nuanced relationship between attentional processes and consciousness.

Location: Leslokaal 1.2

Oral talks 4: Self-Other

Your space and mine: peripersonal space expansion in a social context and its shrinkage in trait anxiety

Francesca Ferroni, Vittorio Gallese, Francesca Rastelli, Martina Ardizzi

Peripersonal space (PPS) is a highly plastic sector of space surrounding our body whose boundaries are mapped through multisensory integration. However, nothing is known about PPS plasticity within a social context. Furthermore, although several studies have investigated the relationship between PPS extent and several personality traits including anxiety, little is known about the relationship of the latter with PPS plasticity. Here we investigated PPS plasticity after a social cooperative interaction and whether trait anxiety could influence it. To achieve this, a novel social motor training, designed to shift participants' PPS boundaries, was developed. Specifically, participants were instructed to manipulate small objects within their reaching space without the use of a tool, collaboratively helped by a confederate who employed a tool in her extrapersonal space. As a control, we asked participants also to perform individual motor training using a tool in their extrapersonal space whose effects on PPS expansion are well-established. Participants underwent a visuo-tactile task to estimate the PPS boundary before and after the two trainings. Results show for the first time that a social cooperative context affects PPS's plasticity: engaging in a cooperative motor interaction with another individual influences PPS plasticity, even when an individual's motor actions are exclusively within one's own reaching space. Most interestingly, anxiety modulates PPS's plasticity direction. People with low anxiety trait show PPS expansion following the social motor training, whereas those with high anxiety trait show PPS shrinkage. Differently, PPS plastic boundary shift after individual motor training is not influenced by anxiety.

Location: Leslokaal 1.2

Oral talks 4: Self-Other

Heartbeats shape cortical networks for distinguishing self vs other touch

Diego Candia-Rivera, Fabrizio De Vico Fallani, Rebecca Boehme, Paula C. Salamone

Research on interoception has revealed the role of heartbeat dynamics in shaping our perceptual awareness and embodying a first-person perspective. These heartbeat dynamics exhibit distinct responses to various types of affective touch. We advanced that those distinct responses in heartbeat dynamics are directly associated to the brain dynamics that allow self-other touch distinction. In our study, we employed a method to quantify the coupling of temporal patterns in cardiac sympathetic and parasympathetic activities with brain connectivity. Our findings revealed that social touch led to an increase in the coupling between brain connectivity and parasympathetic/vagal activity, particularly in the alpha, beta, and gamma bands. Conversely, as social touch progressed, we observed a decrease in the coupling between brain connectivity and sympathetic dynamics across a broad spectrum. These results shed light on the neurophysiological underpinnings of affective touch and demonstrate how heartbeat dynamics are intertwined with the organization of brain activity.

Location: Leslokaal 1.2

Oral talks 4: Self-Other

Ketamine reduces the neural distinction between self- and other-produced affective touch - a randomized double-blind placebo-controlled study

Reinoud Kaldewaij, Paula C Salamone, Adam Enmalm, Andrea J Capusan, Håkan Olausson, Markus Heilig, Rebecca Boehme

A coherent sense of self is crucial for social functioning and mental health. This profound self-experience is widely considered to be grounded in bodily self-awareness. The N-methyl-D-aspartate antagonist ketamine induces short-term dissociative experiences, modelling an altered state of self-perception. This randomized double-blind placebo-controlled within-subject study investigated the mechanisms for ketamine's effects on the bodily sense of self in the context of affective touch. Thirty participants received intravenous ketamine while performing self-touch and receiving touch by someone else during functional MRI – a previously established neural measure of self-other-distinction. Ketamine administration elicited dissociation and reduced neural activity associated with self-other-distinction in the right temporoparietal cortex. This reduction in activation was associated with reductions in interoceptive awareness. The temporoparietal cortex showed higher connectivity to somatosensory cortex and insula during other- compared to self-touch. This difference was augmented by ketamine for somatosensory and insular connectivity. Moreover, the increase in connectivity between the temporoparietal cortex and somatosensory cortex correlated with dissociation strength. We demonstrate that disrupting the self-experience through ketamine administration affects neural activity associated with self-other-distinction in a region involved in touch perception and social cognition. This process may be driven by a ketamine-induced reduction in top-down signaling, rendering the processing of predictable self-generated and unpredictable other-generated touch more similar. Our findings provide further evidence for the intricate relationship of the bodily self with the tactile sense.

Location: Leslokaal 1.2
Oral talks 4: Self-Other

Contagious connections: exploring the blurred boundaries of Self and Other

Giulia D'Adamo, Giulia Arenare, Martina Ardizzi, Francesca Ferroni, Maria Alessandra Umiltà, Vittorio Gallese

Contagious behaviors refer to the phenomenon whereby a behavior (i.e. yawning, itching, etc.) of another individual can trigger a similar response in the observer. Previous studies have shown that the degree of contagion susceptibility might be influenced by interindividual variability and several factors within social interactions, many of which are still unknown. The present research aims to investigate whether the flexibility of the individual's self-other bodily boundaries, supported by bottom-up processes of multisensory integration, plays a role in the dynamics of contagion.

To this purpose, we measured the proneness to contagion (i.e. Contagion Task), the demarcation of self-other boundaries with the Rubber Hand Illusion (RHI) task, and multisensory integration processes with Simultaneity Judgment Task in 50 right-handed participants (25 M, 25 F).

Our results show that participants who are more susceptible to contagion are also those who have higher levels of embodiment in the RHI, hence demonstrating more permeable body boundaries. A direct relationship was found between multisensory integration processes and the demarcation of body boundaries, as supported by the literature.

Taken together, the present data hint at a relationship between the perception of Self-boundaries and permeability to others' bodily displays, in which the quality of the former might represent a relevant factor modulating contagion susceptibility. This relationship could represent a novel element in the investigation of self-other synchronization and a potential factor of self-other merge phenomena in self-perception-related psychopathologies. In summary, the study highlights the links between susceptibility to contagion, embodiment, multisensory integration processes and body boundaries.

Location: Leslokaal 1.2

Oral talks 4: Self-Other

Self-other body-odor comparison as a mechanism behind the chemistry in social chemistry

Inbal Ravreby, Tali Weiss, Barr Herrnsstadt, Michal Ramot, Yaara Yeshurun, Noam Sobel

Nonhuman 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, which, in turn, may promote friendship. To test this, we recruited nonromantic 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. We then recruited complete strangers, smelled them with an electronic nose, and engaged them in nonverbal dyadic interactions. We observed that dyads who smelled more similar had more positive dyadic interactions. In other words, we could predict bonding with an electronic nose. In a continuation, we manipulated participant body-odor (using Deo candies), and exposed them to images and movies of potential friends with either congruent or incongruent body-odor, within an MRI. We then asked the participants to rate on a continuum the images, outside the scanner, and also to perform a recognition test, where in the learning phase half the pictures were coupled with congruent body-odor and half with incongruent body-odor. We found odor-congruency-dependent processing, supporting the notion that self-body-odor provides a template for subconscious comparisons with others' body odor. This suggests that body-odor similarity underlies the chemistry in social chemistry.

Location: Leslokaal 1.3

Oral talks 5: Cognitive control

Causal relationship between frontal beta oscillation phase and different cognitive functions

Miles Wischnewski

Neural oscillations at different frequency bands have been related to a variety of cognitive functions. For instance, frontal beta oscillations are associated with performance on a variety of cognitive tasks, including reinforcement learning, response inhibition, and working memory. Currently, it is unknown how such different functions are encoded within the same neural oscillation. Interestingly, for other oscillations in different brain regions, it has been demonstrated that the phase of an oscillation reflects functional properties. Borrowing this idea, we hypothesized that different phases of the frontal beta oscillation reflect different cognitive processes. To test this idea, we applied repetitive transcranial magnetic stimulation (rTMS) to the dorsolateral prefrontal cortex, with pulses either synchronized to the peak or the trough of the individual theta oscillation. This was compared to a condition in which unsynchronized rTMS was delivered. We were able to couple the pulses to the oscillation phases using a closed-loop system, which reads out and analyzes electroencephalogram (EEG) data in real-time. Before, during, and after rTMS participants performed a battery of cognitive tasks: A reversal learning task, an N-back task, and a go/no-go task. Preliminary results (N = 48) demonstrate significant improvement in go/nogo performance with peak-rTMS, while trough-rTMS improved N-back performance. These results suggest that different cognitive functions are governed by different phases of the same neural oscillation, providing a novel insight into how frontal cortex rhythms are causally related to behavior.

Location: Leslokaal 1.3

Oral talks 5: Cognitive control

Investigating dynamic task representations induced by evolving task uncertainty: an fMRI study

Mengqiao Chai, Iris Ikink, Stefania Mattioni, Ricardo Alejandro Benavides, Nanne Kukkonen, Mehdi Senoussi, Marcel Brass, Clay Holroyd, Senne Braem

One of the hallmarks of human cognitive flexibility is the ability to dynamically adjust and control our intentions and actions in a fast-changing environment. Across a series of behavioral experiments, we previously demonstrated that people can dynamically adjust their task preparation when the to-be-performed task varied in uncertainty (Chai et al, 2023). In the current fMRI study, we aimed to further elucidate the neural mechanisms underlying these dynamics in task control. Specifically, we hypothesized that this dynamic regulation can be observed in the strength of task representations that support flexible goal setting. In the scanner, 45 participants were asked to perform one of nine possible cued image categorization tasks on each trial. Critically, in a subset of blocks, the level of task uncertainty would increase as the cue-target interval (CTI) unfolded. Thus, participants had to keep track of the elapsed time during the CTI, actively infer the uncertainty level of the task, and dynamically modulate the strength of to-be-performed task accordingly. Our fMRI results reveal a strong lateralization among prefrontal regions in monitoring task uncertainty and modulating task strength. Forthcoming decoding and representational similarity analyses will further allow us to examine the dynamic progression of task representations induced by the evolving task uncertainty.

Location: Leslokaal 1.3

Oral talks 5: Cognitive control

Putting the past behind: How to disengage from a no longer relevant task

Inga Lück, Gesine Dreisbach, Rico Fischer

Task switching requires participants to engage in only one of two task-sets in a given trial. Thus, participants either repeat the just executed task or switch to the other. Curiously, if one of the tasks is labeled irrelevant, performance in the remaining task is still worse than when performed as single task. This so-called fade-out cost demonstrates that the suddenly irrelevant task cannot be discarded immediately (Mayr & Liebscher, 2001).

In the present study, we used list-wide proportion manipulations to trigger control states during task switching before eliminating one task (fade-out block). The control states were induced either at the task-set level by manipulating the proportion of task switches (Experiment 1) or at the response level by manipulating the proportion of response-conflict (Experiment 2). Increased switch-frequency should lead to the concurrent activation of both task-sets in working memory. If fade-out costs originate at the task-set level, increased switch-frequency should amplify fade-out costs compared to the low switch-frequency condition (Experiment 1). In Experiment 2, high conflict-frequency (mostly incongruent condition) should enhance task shielding. If fade-out costs originate at the response level, high conflict-frequency should ease disengagement and potentially reduce fade-out costs.

Results showed larger fade-out costs for conditions of high switch-frequency (Experiment 1), whereas conflict-frequency did not impact fade-out costs (Experiment 2). These findings suggest that different forms of cognitive control demands, i.e., switching between tasks and shielding the current task set, seem to operate at different (hierarchical) representational levels. Implications for the internal representation of task models will be discussed.

Location: Leslokaal 1.3

Oral talks 5: Cognitive control

Episodic retrieval of cognitive control demand: A computational model

Sven Wientjes, Clay Holroyd

Humans can satisfy a large variety of abstract goals, such as driving to work or doing the weekly grocery shopping. This requires the maintenance of contextual information to guide neural information processing through top-down mechanisms (Miller & Cohen, 2001). Functions subserving this ability are collectively referred to as “cognitive control”. Experimental investigations of cognitive control often present multi-dimensional stimuli with potentially conflicting information (e.g. the Stroop task or the Flanker task) or require switching between multiple tasks with different response demands for the same stimuli (e.g. task-switching studies). Previous work has found that allocation of cognitive control in these tasks is dynamic, adjusting to recent history (e.g. Gratton et al, 1992), but also long-term expectations (e.g. Bugg, 2014; Siqi-Liu & Egner, 2020) and item-specific expectations (e.g. Bugg et al., 2011; Chiu & Egner, 2017). In three new experiments, we show how “temporal context” (Howard & Kahana, 2002) can be seen as a primary driver of cognitive control allocation and develop a novel computational model that can explain these and several previous effects (Gonthier et al., 2016; Whitehead et al., 2020; Dignath & Kiesel, 2021; Geddert & Egner, 2022) that earlier models (Botvinick et al., 2001; Verguts & Notebaert, 2008; Lieder et al., 2018) cannot account for.

Location: Leslokaal 1.3

Oral talks 5: Cognitive control

Different measures of fatigue during cognitive processing in lab experiments

Maarika Traat, Kairi Kreegipuu, Aire Raidvee

An individual's state is crucial in information processing and may cause fatal mistakes. It is something that holds significance both in life and laboratory experiments. We examined the dynamics and correlates of fatigue throughout a 2-hour series of experiments. Basic fatigue measures were blink amplitude and blink frequency, self-ratings, and critical flicker fusion (CFF). Participants ($n = 66$, $M_{age} = 28.29$, $SD_{age} = 8.68$) took part in a cognitive test battery with stop-signal, reaction time, memory, and pre-attentional information processing (auditory and visual mismatch negativity) tasks. All tasks were performed twice, at least one week apart, to test reliability of all analyses. The analysis of variance (ANOVA) revealed an increase in participants' subjective ratings of fatigue throughout the experiment and both lab sessions, as indicated by a robust main effect ($F(2, 96) = 65.41$, $p < 0.001$, $\eta^2_G = 0.09$). Blink amplitude decreased during both lab sessions ($F(2, 150) = 11.754$, $p < 0.001$, $\eta^2_G = 0.02$). Blink frequency did not change consistently in the experiment, and for CFF the decrease was statistically significant only at the second occurrence of experimental series ($t(65) = 4.11$, $p = .0001$).

The study is a part of a project that aims to compare different measures of fatigue and relate them to objective cognitive performance measures.

Location: Leslokaal 3.2

Oral talks 6: Autism

Musical and linguistic syntax processing in autistic and neurotypical individuals: An event-related potential (ERP) study

Jiayin Li, Fang Liu

The Shared Syntactic Integration Resource Hypothesis (SSIRH) suggests a shared neural mechanism for syntax processing in language and music, based on the observation that similar brain regions are involved in integrating syntactic elements in both domains (Patel, 2003). Given that individuals with autism spectrum disorder (ASD) demonstrate intact musical structural processing (Quintin et al., 2013) but struggle with linguistic syntax processing (Stockbridge et al., 2014), comparing syntactic processing between music and language in autism can provide valuable insights into the SSIRH.

The current electroencephalographic study investigates how individuals with and without autism process language and music syntax, focusing on P600, an ERP component elicited by syntactic incongruities. Participants were presented with spoken sentences and musical phrases containing either grammatical or ungrammatical syntax, with a task of listening and judging the sound clip they heard as “acceptable” or “unacceptable”.

Both groups showed a P600 effect in response to syntactic violations in language and music. In the language trials, the ASD group exhibited a larger and more widespread P600 effect and higher behavioural accuracy than the neurotypical group. However, their behavioural responses and P600 patterns to musical syntax remained similar to the neurotypical group, indicating typical musical syntax processing in autism.

These findings challenge the predictions of the SSIRH, indicating that linguistic, but not musical, syntactic processing may be atypical in ASD. The study suggests a dissociation between linguistic and musical syntactic processing in this population, contributing to our understanding of autism-related cognitive differences.

Identifying Neural Markers of Facial Expression Recognition in a Neurodiverse Sample

Ozge Gezer, Elisabeth Von Dem Hagen, Stephanie Van Goozen

Facial expression recognition (FER) is vital for understanding social cues in interpersonal interactions. Deficits in FER are commonly observed in a range of neurodevelopmental disorders including autism spectrum disorder, conduct disorder, and attention-deficit hyperactivity disorder (Griffin et al., 2020; van Goozen et al., 2022; Staff et al., 2021). Despite extensive research on FER and its neural markers within psychopathologies, there is little known about the shared underlying neural markers of FER across a neurodiverse sample.

38 children (7-12 years old), with a range of behavioural phenotypes, including emotional and behavioural difficulties, but without a mental health diagnosis, took part in the study. Children had a structural MRI scan and completed a computer-based FER task. Source-based Morphometry (Xu et al., 2019), an innovative data-driven, independent component analysis approach, was used to identify networks of brain regions exhibiting similar patterns of grey matter volume covariance. Within these networks, each child's FER ability was then related to their contribution to the component network.

We identified one network that was significantly linked to FER ability across the sample. This network of regions included the middle temporal gyrus (MTG), postcentral gyrus (PCG), middle frontal gyrus (MFG), and inferior frontal gyrus (IFG). Within this network, MTG and PCG were negatively correlated with FER ability, indicating that better recognition was associated with lower gray matter volume, whereas MFG and IFG were positively associated with FER ability.

These findings suggest there are common underlying neural markers of FER in a neurodiverse sample, highlighting the importance of transdiagnostic approaches.

Location: Leslokaal 3.2
Oral talks 6: Autism

Spontaneous socioemotional learning in autism: the impact of gender and affective traits

Julie Grèzes, Morgan Beaurenaut, Klara Kovarski, Constance Destais, Rocco Mennella

Individuals with Autism Spectrum Condition (ASC) exhibit atypical social interactions compared to Typically Developing individuals (TD). The social motivation theory suggests that these difficulties arise from reduced anticipation, reception, and/or learning from social rewards. Although learning from socioemotional outcomes is central to the theory, studies to date have been limited and inconsistent due to various methodological limitations. Here, we conducted a large-scale study using an ecologically valid social learning task to overcome these limitations. The study included two large online cohorts with (n=274) and without (n=290) ASC, carefully matched for gender, age, and education. Participants were asked to indicate their preferred seat in a waiting room, with each seat associated with different probabilities of sitting next to happy or angry individuals. The task was implicit and did not explicitly mention emotions to the participants. Contrary to the predictions of the social motivation theory, both ASC and TD groups showed spontaneous learning from socioemotional outcomes (approach happy/avoid angry). However, when accounting for dimensional variations in autistic traits, depression, and anxiety, two main findings emerged among females who failed to develop explicit learning strategies: 1) autism severity in ASC correlated with reduced learning to approach happy individuals; 2) anxiety-depression severity in both ASC and TD participants correlated with reduced learning to approach/avoid happy/angry individuals, respectively. These findings challenge the idea that social learning impairments are a general characteristic of autism and suggest that they may be specific to females with ASC when they lack explicit strategies for adapting to their social environment.

Location: Leslokaal 3.2

Oral talks 6: Autism

Using wearable sensors to gauge interpersonal synchrony among autistic and neurotypical children

Jamie A Ward, Antonia Hamilton

People often spontaneously synchronise with one other during social interactions, but this synchrony is not always present in autism. There are few methods available for measuring social synchrony outside the lab, which makes it hard to know what natural patterns of synchrony should look like.

Here we present a system of wrist-worn movement sensors and a measure of interpersonal synchrony, which we use to uncover social behaviours in young autistic people with learning difficulties. We used Fitbit-like sensors to collect data from the interactions of 3 groups of children (and adults) during school activities: autistic children aged 5-6, autistic children aged 12-17, and neurotypical children aged 4-5. We evaluate 3 variants of cross wavelet analysis to calculate interpersonal synchrony between all possible pairings. The output of this analysis and the proposed visualisations provide a convenient way to estimate of social engagement.

We compare our measures to blind independent video ratings of social engagement and find a clear positive correlation, which validates the use of sensors for in-the-wild studies of social behaviour in autism. Second, we compare levels of synchrony across different age groups to characterise patterns of spontaneous social interactions which arise in real-world classroom settings. We also discuss the challenges of collecting real-world data from these groups. The results show how wearable sensors enable a new type of research on real-world social interactions and advance our understanding of social synchrony.

Location: Leslokaal 3.2

Oral talks 6: Autism

Multisensory integration of naturalistic speech stimuli in autistic and non-autistic adults

Magdalena Matyjek, Sotaro Kita, Mireia Torralba Cuello, Salvador Soto Faraco

Understanding face-to-face spoken communication requires integrating auditory and visual information, spanning from perceptual spatio-temporal correlations between sensory signals to semantics. This multisensory integration (MSI) facilitates faster, more accurate processing and it is an important basis for human socio-communicative development. In autism, disruptions of MSI for simple stimuli are well documented, and similar disruptions with complex stimuli may contribute to communication difficulties and challenging social interactions. To understand this, it is crucial to explore MSI in autism under real-life scenarios, using complex speech utterances accompanied with visual information from the speakers' faces and gestures, in a socially meaningful context. We measured MSI for speech accompanied by iconic gestures in an ecologically valid, naturalistic situation in non-autistic and autistic adults. For both groups, audio-visual stimuli led to higher accuracy and faster reaction time in the word recognition task, and enhanced alpha suppression in the EEG. However, only the non-autistic group revealed non-linear MSI effects at the neural level. These findings suggest that both autistic and non-autistic adults benefit from multisensory speech signals, but perhaps through different neuronal mechanisms. Whilst the non-autistic group showed non-linear integration of bimodal information, the autistic group appeared to primarily benefit from the linear addition of audio and visual cues. Although not directly impairing efficiency, as MSI benefits showed, this atypicality could contribute to social communication challenges for individuals in the spectrum indirectly. Specifically, it may heighten the effort needed for speech processing, consequently impacting social interactions.



May 23^d – 5:30pm – 7:00pm

SYMPOSIA

*Location: Auditorium 2
Symposium 13*

Embodied Emotions: Exploring the Dynamic Interplay of Bodily Sensations and Feelings

Giada Lettieri, Giuseppina Porciello, Sarah Garfinkel, Ignacio Rebollo

This symposium aims to identify novel psychophysiological fingerprints of emotional states. From the gut's impact on emotions, and autonomic reactivity in ADHD, we combine findings from diverse populations, including those with ADHD and blind individuals, alongside innovative methodologies. These methodologies include pioneering haptic tools tailored for blind populations, ingestible pills gauging the gastrointestinal activity (ph, pressure and temperature), and a pharmacological manipulation (domperidone administration) targeting stomach rhythm. This research opens new avenues for understanding the deep role of bodily signals in shaping both typical and atypical emotional experiences.

Talk 1 - I. Rebollo, A. Lazova, A. DeSouza, S. Bousaba, K. Krupko, W. Huang, S.Q. Park Emotions and bodily sensations

Emotional experiences are grounded in the body, but whether bodily changes are the cause or consequence of bodily experience, and whether they can act as emotional fingerprints is a matter of debate. First, I present results from an online study (n=300) in which participants were shown videos inducing different types of emotions (appetitive, disgusting, neutral, positive and negative affect), after which they had to provide subjective ratings of affective experience, and draw in a human silhouette where they felt bodily changes. Using a linear discriminant analysis, we could classify the emotional category participants watched based on the subjective drawings. Moreover, we discovered strong links between various personality traits and drawings of bodily sensations, backing the idea of bodily sensations as emotional fingerprints.

In the second part of this talk, I present results of an fMRI experiment (n=30) designed to causally demonstrate the role of bodily signals in affective experience. We conducted a double blind, placebo controlled pharmacological intervention with domperidone (10 mg), a drug that regulates the rhythm of the stomach. Participants watched a subset of the emotional videos used in the online experiment in the scanner, and provided subjective ratings of different dimensions of affective experience. We found specific bodily and brain markers for the different emotional categories, and significant differences in behavioural, autonomic and brain responses to the emotional videos when comparing domperidone versus placebo conditions. Taken together, these results speak for a causal role of bodily sensations in the experience of emotions.

Talk 2- G. Porciello, A. Monti, M.S. Panasiti & S.M. Aglioti**Ingestible pills reveal the contribution of the gut to the emotional experience**

While conventionally regarded as serving primarily a homeostatic function, gastrointestinal (GI) signals have emerged as potent indicators of emotional processes, albeit lacking direct evidence to establish their link. One of the reasons why the internal milieu of the GI system is poorly investigated is because internal organs are difficult to access and monitor.

To assess the direct impact of endoluminal markers of GI activity on emotional responses, we asked a group of healthy male participants to ingest a pill that measured pH, pressure, and temperature of their GI tract while they were exposed to videos that consistently induced disgust, fear, happiness, sadness or a neutral state. These internal markers of GI physiology were complemented by participants' self-reported visceral sensations (gastric, respiratory and cardiac), perceived emotions, as well as heart rate (HR) and heart rate variability (HRV) recordings.

Our findings revealed that gastric sensations were mostly evoked by fearful and disgusting videos, and that perceived emotions were linked to the stomach activity. Specifically, the more acidic the pH, the more participants reported feelings of disgust and fear; the less acidic the pH, the more they reported happiness. Additionally, disgusting videos were associated with a significant increase in HRV and together with fearful video clips with a decrease in HR.

These findings highlight a crucial role of the stomach in the emotional experience of disgust, fear and happiness and that ingestible pills may open new avenues for exploring the deep-body physiology of emotions.

Talk 3 - G. Lettieri, R.P. Calce, E. Giraudet & O. Collignon**Bodily representation of emotions in blind people**

The body plays a fundamental role in the expression of emotions, as affective states often relate to facial configurations, postures, and gestures (Levenson, 2003). All these signals require a fine-tuned sense of vision to be detected (Itier and Batty, 2009). Nevertheless, if and how the lack of sight impacts the bodily representation of emotions is unexplored.

We developed a haptic tool using a 50cm human mannequin with a recording camera on top (1080p, 60fps). Twenty early blind (9F) and 20 age-matched sighted (10F) participated in the experiment. They had to indicate with their dominant index finger the parts of the body they felt activated when experiencing 15 positive and 15 negative emotions. A marker was applied to the finger to track their movement. The body silhouette was aligned across recordings and the marker segmented using a color threshold algorithm. We obtained for each volunteer and emotion a map of activated regions, smoothed using a Gaussian filter. A pixelwise unpaired t-test (1000perm) provided family wise corrected p-values of the between-groups contrast.

We found differences between blind and sighted in the bodily maps of euphoria ($p_{FWC}=0.02$) and love ($p_{FWC}=0.003$). For euphoria, sighted reported bodily sensations in the face and stomach, while blind participants the mouth region only. Similarly, for the feeling of love, sensory-deprived individuals do not report the stomach region, that is prominent in sighted.

Overall, blind individuals seem to rely more on the head region, compared to sighted, suggesting that vision plays an important role in the representation of emotions.

Talk 4 - S. Garfinkel & B. Greenwood

Heightened emotional reactivity in ADHD

Attention Deficit Hyperactivity Disorder (ADHD) is a neurodevelopmental condition characterised by developmentally atypical inattention and/or hyperactivity and impulsiveness (American Psychiatric Association, 2013). Within this context, poor regulation is viewed as integral to ADHD, and evidence is emerging that this may also extend to impaired emotion regulation. We will present a series of psychophysiological studies to demonstrate that ADHD is associated with heightened emotion reactivity, manifesting as (1) increased strength of emotional reactions, (2) altered empathetic reactivity, and (3) heightened rejection sensitivity dysphoria, defined as a cognitive-affective processing disposition to anxiously expect, readily perceive, and overact to rejection. Body and brain dynamically interact to shape emotion profiles, and changes in autonomic reactivity may underscore augmented emotional profiles in ADHD which in turn have implications for cognition and attention in this condition. Together this work signifies that changes in autonomic regulation underscoring heightened emotional reactivity is an integral component of ADHD.

Thursday, May 23rd 2024 // 5:30pm - 7:00pm

*Location: Auditorium 4
Symposium 14*

Enhance associative neural plasticity through innovative protocol of non-invasive brain stimulation: cortico-cortical paired associative stimulation

Sara Borgomaneri, Simone Battaglia

Our symposium offers a comprehensive exploration of cutting-edge non-invasive brain stimulation protocols, with a specific focus on cortico-cortical paired associative stimulation. This symposium will delve into the latest advances in cognitive and affective neuroscience, where we discuss the intricate mechanisms that drive associative neural plasticity in the human brain. This scientific symposium will present a unique opportunity to gain insights into the forefront of non-invasive brain stimulation techniques, fostering a deeper comprehension of the human brain's cognitive and affective capabilities.

Talk 1 - Andrea Casarotto

PMv – M1 plasticity induction modulates M1 activity during specific grasping actions

The functional connections between ventral premotor cortex (PMv) and primary motor cortex (M1) represent a critical node for the organization of goal-directed actions. The repeated activation of these connections by means of cortico-cortical paired associative stimulation (cc-PAS) may induce Hebbian-like plasticity. In multiple experiments, we investigated the neurophysiological and behavioural modulation induced by PMv-M1 cc-PAS protocol at rest and during the execution of precision and power grip actions. In these experiments, we systematically varied the current direction (posterior-anterior – PA; anterior-posterior – AP), induced during the cc-PAS protocol, in order to induce long-term changes in the activity of different neuronal circuits within M1. Indeed, previous evidence suggested that multiple neuronal populations within M1 are specifically involved in the control of precision rather than power grip. At rest, we highlighted how different coil orientations led to different long-lasting effects on M1 and PMv-M1 connections activity (LTP- or LTD-like after-effect). Exploring the effect of the PMv-M1 plasticity induction on the isometric grasping execution, we highlighted how distinct neural circuits differently contributed to the execution of these actions. The repeated activation of PMv-M1 network with PA orientation over M1 did not change its motor drive during both actions. Conversely, the PMv-M1 cc-PAS stimulating M1 with an AP direction led to a preferential modulation of the precision grip motor drive. For the future, preliminary data show how the PMv-M1 plasticity induction could modulate the M1 inhibitory activity during the action preparation phase, as well as the kinematics of the grasping actions.

Talk 2 - Jelena Trajkovic

Changing connectivity between premotor and motor cortex changes inter-areal communication in the human brain

The oscillatory synchronization is increasingly being appreciated to reflect communication between cortical network elements. However, it has proven difficult to assess because most techniques for altering communication between areas also alter the intrinsic activity in the areas themselves. Here we implement a paradigm in which paired stimulation of two human cortical regions is used to either increase or decrease the interactions between the two areas while controlling for activity levels in each component area. We focus on the ventral premotor cortex (PMv) as its connectional anatomy suggests that it may be an important route through which prefrontal cortex influences the motor system. We show that increasing connectivity between components parts of the cortical motor system – PMv and primary motor cortex (M1) – increases interregional phase synchrony in two types of oscillatory activation patterns in the beta and alpha range. By contrast an identical manipulation of activity in the two areas but administered in a manner which leads to decreased connectivity, led to a decrease of interregional phase synchrony in the theta oscillatory activity. Moreover, we show that these changes in interregional oscillatory connectivity, which are visible at rest, are predictive of changes in oscillatory power seen in the same frequency bands during movement execution and inhibition.. These results unveil a link between the physiology of the motor network and the resonant frequencies mediating its interactions and provide a putative mechanism underpinning the relationship between synaptic efficacy and brain oscillations

Talk 3 - Sara Borgomaneri

Emotion in Action: Boosting brain network plasticity to ameliorate action control in an emotional context

Swiftly halting ongoing motor actions is essential to react to potentially perilous circumstances. However, the complex interplay between emotions and motor control as well as the subtending neural bases have been scarcely investigated. The ability to inhibit prepotent responses can be investigated using stop-signal tasks (SST), designed to provide a sensitive measure of action suppression. In a series of behavioral SST studies, we have demonstrated the facilitatory effects that emotions exert on action control. Subsequently, we went to investigate the neural underpinnings of such interaction by delivering Transcranial Magnetic Stimulation (TMS) over key brain regions known to be involved in action inhibition, such as the supplementary motor cortex (pre-SMA), the right inferior frontal gyrus (rIFG), and the primary motor cortex (M1). Results demonstrated that partially segregated brain regions are devoted to action control in emotionally arousing situations. Namely, results show that TMS over pre-SMA influences the ability to inhibit prepotent action when emotionally arousing stimuli are presented. In contrast, action control in a neutral context is modulated by the rTMS over the rIFG. No effects were found stimulating M1. Finally, we applied a new TMS protocol, called corticocortical paired associative stimulation (ccPAS), aiming at enhancing the connectivity between different nodes of the action inhibition network (AIN). We demonstrated that specific connections within the AIN are instrumental to action control in an emotional context and functionally malleable via manipulation of

associative plasticity. These findings pave the ground for future exploration of brain mechanisms responsible for action inhibitions in pathological conditions

Talk 4 - Simone Battaglia

Driving associative connectivity in the visual processing pathway to strengthen re-entrant feedback projection from STS to V1

Classical models of visual processing in the primate brain delineate two primary pathways, dedicated to object recognition and spatial perception, respectively. However, recent evidence has unveiled the existence of a third visual pathway along the brain's lateral surface, originating in the early visual cortex and extending into the superior temporal sulcus (STS). The third pathway seems to be involved in the process of social and emotional content of stimuli, but it is not still clear how this visual processing pathway is functionally organized in the human brain. Our study aims to investigate the functional organization of this pathway, particularly within the STS, focusing on its encoding of emotional expressions and emotion-specific representations. To this aim, we employed a state-dependent paired associative stimulation (ccPAS) protocol to modulate cortico-cortical connectivity between STS and the primary visual cortex (V1). Sixty healthy volunteers were divided into four groups and tasked with emotion discrimination while observing happy or fearful facial expressions before and after ccPAS administration. The results indicate that the state-dependent ccPAS protocol, particularly through STS/V1 stimulation, selectively activates neurons primed by the simultaneous emotional stimulus. In particular, these findings show a higher-level functional specialization of neurons in the STS, responsive to visual emotional stimuli based on the conveyed emotion and pre-activation induced by the ccPAS protocol. Furthermore, demonstrates the malleability of the visual neural pathway through state-dependent ccPAS, offering insights into the functional connectivity and neuronal specificity of the temporo-occipital areas.

*Location: Auditorium 1
Symposium 15*

Recent developments in the Social and Emotional cerebellum

Frank Van Overwalle

In this symposium, Frank Van Overwalle presents a meta-analysis involving a decade of work on social mentalizing and the sequencing hypothesis, postulating that the cerebellum identifies and encodes action sequencing underlying social mentalizing. Viola Oldrati focuses on the impact of cerebellar neuromodulation on action prediction Skills. The next two speakers employ non-invasive cerebellar stimulation. Beatriz Catoira investigates the effects of cerebellar transcranial direct current stimulation (tDCS) on the identification of social sequences and brain activation, and Chiara Ferrari uses transcranial magnetic stimulation (TMS) to reveal the time course during emotion discrimination.

Talk 1 - Frank Van Overwalle

Dynamic sequences of social human actions supported by the cerebellum and basal ganglia

The posterior cerebellum and anterior basal ganglia are critical structures for sequence learning and identification of dynamic social action patterns. Although the role of the cerebellum was extensively investigated during the last decade, the role of the basal ganglia was long ignored. To reveal the differential contribution of these two subcortical structures, we conducted an ALE coordinate-based meta-analysis of recently published social sequencing tasks (spanning a total of 485 participants in 19 studies) which encompassed a variety of social mentalizing inferences ranging from low-level goals to high-level beliefs and traits, while participants memorized, generated or predicted the temporal sequence of the social actions involved (i.e., social sequencing condition) or did not (i.e., social non-sequencing control condition) or did so for non-social objects (i.e., non-social sequencing control condition). The results showed that the mentalizing networks of the posterior cerebellum and anterior basal ganglia were preferentially recruited for social sequencing (as opposed to all control conditions). However, the results also showed that there was a ten-fold larger cluster of activation for social (vs. non-social) action in the posterior cerebellum, and a somewhat larger cluster for sequencing (vs. non-sequencing) in the anterior basal ganglia. In contrast, non-social sequencing recruited these mentalizing areas only minimally.

Talk 2 - Viola Oldrati

Exploring the Impact of Cerebellar Neuromodulation on Action Prediction Skills: Insights from Healthy and Clinical Populations

The posterior cerebellum is a recently discovered node of the social brain. However, its anatomy makes it difficult to apply traditional approaches to investigate the temporal aspects of brain processing; therefore, nothing is known about the time course of the contribution of this region to social processes. To overcome this gap, in the first experiment, we systematically investigated the time course of the *causal* involvement of the cerebellum in an emotional discrimination task by employing a chronometric transcranial magnetic stimulation (TMS) approach. We revealed that when perceiving emotional faces the medial posterior cerebellum is recruited in the initial stages of emotional processing, beginning at 100 ms from stimulus onset. Furthermore, in a second experiment, we showed that this recruitment is simultaneous to the posterior superior temporal sulcus (pSTS), a well-known core region of the specialized brain network for perceiving emotional faces. In a last experiment, we qualified the co-activation between the posterior cerebellum and pSTS by using a dual-site condition-and-perturb TMS approach through which we tested the hypothesis that interfering with activity in the cerebellar regions should affect the processing of information in pSTS (index of causal functional connectivity). We showed that the recruitment of the pSTS during the perception of facial expressions is contingent on the level of cerebellar activation, providing evidence that cerebellar-to-pSTS communication is instrumental to processing emotions in others' faces.

Talk 3 - Beatriz Catoira

Cerebellar tDCS to improve social understanding

Over the past decades, research has increasingly highlighted the cerebellum's multifaceted involvement beyond motor functions, particularly in the domain of social cognition. One crucial cognitive process is mentalizing, which involves the ability to ascribe mental states, such as desires, intentions, and beliefs, to others. The cerebellum has been linked to the process of mentalizing which involves the use of social action sequences to predict future actions.

In a series of studies we applied tDCS over the cerebellum in order to evaluate the effect of cerebellar stimulation in the mentalizing network. In the first study we focused on a picture sequencing task in which we compared the ordering of sequences that require belief mentalizing, with social routine and non-social sequences. fMRI analysis revealed that stimulating the cerebellum decreased performance on the task and decreased activity on areas of the mentalizing network such as the TPJ and the precuneus. In order to further understand the effect of the stimulation a novel and more focal montage was developed and it is currently being tested in a sample of autistic and neurotypical participants.

These studies present an innovative approach to investigate the effects of cerebellar tDCS on mentalizing abilities. We offer a comprehensive exploration of the cerebellum's role in social mentalizing through the integration of tDCS, neuroimaging techniques and electrical current simulations. Ultimately, our findings may have implications for the development of interventions targeting social cognition deficits using non-invasive brain stimulation techniques.

Talk 4 - Chiara Ferrari

TMS reveals the time course of the cerebellum and cerebellum-social brain causal connectivity during emotion discrimination

The posterior cerebellum is a recently discovered node of the social brain. However, its anatomy makes it difficult to apply traditional approaches to investigate the temporal aspects of brain processing; therefore, nothing is known about the time course of the contribution of this region to social processes. To overcome this gap, in the first experiment, we systematically investigated the time course of the *causal* involvement of the cerebellum in an emotional discrimination task by employing a chronometric transcranial magnetic stimulation (TMS) approach. We revealed that when perceiving emotional faces the medial posterior cerebellum is recruited in the initial stages of emotional processing, beginning at 100 ms from stimulus onset. Furthermore, in a second experiment, we showed that this recruitment is simultaneous to the posterior superior temporal sulcus (pSTS), a well-known core region of the specialized brain network for perceiving emotional faces. In a last experiment, we qualified the co-activation between the posterior cerebellum and pSTS by using a dual-site condition-and-perturb TMS approach through which we tested the hypothesis that interfering with activity in the cerebellar regions should affect the processing of information in pSTS (index of causal functional connectivity). We showed that the recruitment of the pSTS during the perception of facial expressions is contingent on the level of cerebellar activation, providing evidence that cerebellar-to-pSTS communication is instrumental to processing emotions in others' faces.

Thursday, May 23rd 2024 // 5:30pm - 7:00pm

Location: Leslokaal 1.2
Symposium 16

Biopsychosocial Perspectives on Stress: Indicators, Consequences, and Interventions

Jonathon McPhetres, Thuy-vy Nguyen, Siri Leknes, Jeremy Jamieson

This symposium will explore multidisciplinary approaches to understanding stress, incorporating biological, psychological, and social indicators. Presentations will focus on the biological underpinnings of stress, the behaviour it engenders, its mental health implications, and how we might further this understanding for beneficial outcomes.

Talk 1 - Jonathon McPhetres

Decoding Stress and Health through Salivary Proteomics: Methods, Insights, and Applications

Salivary proteomics has traditionally focused on markers of dental diseases. However, the breadth of proteins and enzymes in saliva mirrors systemic conditions, offering a window into a variety of physiological states. Here, I explore the potential of salivary proteomics as a pivotal tool for both experimental psychophysiological research and personalized medicine. Across a series of four experiments, I compared diverse sample collection and pooling strategies. Twenty-four subjects were exposed to intense aerobic exercise and provide pre and post saliva samples. The culmination of this research is an optimized protocol adeptly balancing between-person variation with the precision of within-person biological replicates. As a result, over 400 proteins were identified. Notably, 20 of these proteins were modulated by the exercise regimen. Further, using GO/KEGG analyses, intriguing insights surfaced about the biological mechanisms underpinning stress. Furthermore, the nuanced proteomic patterns hint at the capacity to identify individual health concerns. This study underscores the transformative potential of salivary proteomics, pushing the boundaries of its applications beyond dentistry and into the realms of psychophysiology and individualized healthcare.

Talk 2 - Thuy-vy Nguyen

Solitude-seeking as Dysregulated Response to Aversive Experiences

This research looked at solitude seeking as dysregulated response to stress. In Study 1, individuals' hourly experiences from 8AM to 10PM for a day. We measured participants' appetitive (e.g., excitement) and aversive emotions (e.g., tension), whether they were alone or with others, and their preferred state at the time of the signal. We gathered 4338 surveys from 362 participants, with 103 participants completing all hourly surveys. Results revealed that throughout the day, as participants continue to be alone,

at some point, they prefer to be with other people. This is consistent with the social homeostasis hypothesis, which suggests that individuals regulate and respond to their needs for social contact when being deprived of it to regain social homeostasis. However, when the participants experience high levels of aversive emotions such as frustration, anxiety, or anger, they continue to prefer being alone even after continued exposure to solitude. This finding suggests that aversive states in solitude do not necessarily correlate with the desire for social contact, but instead less of it. We followed up on these findings with a lab experiment in which participants were exposed to demanding and aversive experiences. We measured change in cortisol levels and preference for solitude (versus to social contact) to investigate the causal effect of aversive experiences on desire for solitude. Further understanding of why this happens will allow us to differentiate when people seek social contacts to regain social homeostasis and when they might prefer not to, and for what reasons.

Talk 3 - Siri Leknes

Stress-enhanced Opioid Self-administration in Healthy Men: A Randomized Controlled Experimental Medicine Study

Men are disproportionately likely to develop opioid use disorder, yet the mechanisms of addiction risk in men and women remain poorly understood. Preclinical, epidemiological and clinical studies converge upon stress as a key risk factor. To determine the mechanisms through which stress alters abuse liability, we measured opioid self-administration after acute stress induction in healthy men and women. Sixty-three healthy participants (31 men) completed four sessions in this repeated-measures, double-blind placebo-controlled randomized study. Social stress or a neutral control state was induced before injection of oxycodone (3.1mg/70kg) or saline. The primary outcome was amount of additional oxycodone obtained in an effortful self-administration task (0-125% of the sampling dose effect). The resulting dose was administered ~40 minutes later. Subjective, autonomic and endocrine responses were collected throughout sessions. Data were analyzed using Hierarchical Bayesian regressions. Pre-exposure to stress increased oxycodone self-administration by 5 percentage points (95% credible interval, 1 to 10, Posterior probability (Pr) > 0.99), but with a robust sex difference (16 percentage points; 95% credible interval, 7 to 24; Pr > 0.99). Stress induction only increased self-administration in men, although women showed higher stress responses. In both sexes, oxycodone induced drug high but did not improve mood or cause clear stress relief. We found no evidence that stress-enhanced drug wanting was related to stress relief or drug liking in men or women. By demonstrating a robust sex difference in stress-enhanced opioid self-administration, the study unveils a putative mechanism for men's higher vulnerability to opioid addiction.

Talk 4 - Karishma Sing, Jeremy Jamieson

Biopsychosocial Approaches to Optimizing Stress

Social-evaluative stressors—experiences in which people feel they could be judged negatively—pose a major threat to adolescent mental health and can cause young

people to disengage from stressful pursuits, resulting in missed opportunities to acquire valuable skills. Here we show that replicable benefits for the stress responses of adolescents can be achieved with a short (around 30-min), scalable 'synergistic mindsets' intervention. This intervention, which is a self-administered online training module, synergistically targets both growth mindsets (the idea that intelligence can be developed) and stress-can-be-enhancing mindsets (the idea that one's physiological stress response can fuel optimal performance). In six double-blind, randomized, controlled experiments that were conducted with secondary and post-secondary students in the United States, the synergistic mindsets intervention improved stress-related cognitions (study 1, $n = 2,717$; study 2, $n = 755$), cardiovascular reactivity (study 3, $n = 160$; study 4, $n = 200$), daily cortisol levels (study 5, $n = 118$ students, $n = 1,213$ observations), psychological well-being (studies 4 and 5), academic success (study 5) and anxiety symptoms during the 2020 COVID-19 lockdowns (study 6, $n = 341$). Heterogeneity analyses (studies 3, 5 and 6) and a four-cell experiment (study 4) showed that the benefits of the intervention depended on addressing both mindsets—growth and stress—synergistically. Confidence in these conclusions comes from a conservative, Bayesian machine-learning statistical method for detecting heterogeneous effects. Thus, our research has identified a treatment for adolescent stress that could, in principle, be scaled nationally at low cost.

Thursday, May 23rd 2024 // 5:30pm - 7:00pm

Location: Leslokaal 1.3
Symposium 17

Neurocomputational Representations of Learning Behavior in Social Interactions.

Jean-Claude Dreher, Lei Zhang, Yulong Huang

Understanding the intricate neurocomputational mechanisms that govern social interactions is crucial for unraveling the complexity of human behavior and its evolutionary roots. The goal of this symposium is to bring together researchers embracing the complex learning behaviors of social interactions in dynamic environments using various techniques including computational modeling, fMRI, MEG, and causal (brain stimulation) approaches. These diverse research endeavors contribute to a nuanced understanding of the neural mechanisms underpinning social cognition, decision-making, and learning, enriching our comprehension of the developmental and evolutionary aspects of adaptive social behavior.

Talk 1 - Jean-Claude Dreher

Neurocomputational mechanisms engaged in social interactions

I will present a taxonomy of different types of computations used by the brain for learning and inferences made during social interactions. I will illustrate how this taxonomy is useful to understand social interactions computations in humans (adults, children) and in non-human primates (Guinea baboons). In particular, I will present recent model-based fMRI results showing how the adult human brain adapts to fluctuating intentions of others when the nature of the interactions (to cooperate or compete) is not explicitly and truthfully signaled. In children, I will report experimental and modeling results elucidating how the computational mechanisms underlying this ability evolves with age from 3 to 9 years old. In Guinea baboons (*Papio papio*), I will present behavioral and computational modeling results showing that mentalizing underly dynamic strategic coordination. Together, these findings provide a developmental and evolutionary computational account of how the brain makes adaptive social decisions.

Talk 2 - Jiamiao Yang & Judit Campdepadrós

A computational perspective on factors influencing learning in self-other morally conflicting situations

How individuals learn the consequences of their actions in morally conflicting situations in which increasing gains for the self are associated with increasing pain to others remains poorly understood. Here we explore the impact on such learning that four factors have: the gender of the decision-maker, of the pain receiver; whether the pain is conveyed via facial expressions or descriptions; and how the conflict is framed

(helping vs harming). We use a core experimental task, in which participants learn symbol-outcome associations in such a morally conflicting situation. Two symbols represent choices leading probabilistically either to high monetary rewards for the self but harm to another or less monetary rewards for the self while avoiding harm to another. We leverage two studies totaling over 300 participants, and use a hierarchical Bayesian reinforcement learning model to investigate individual differences in individuals' preferences and learning characteristics (learning rate and inverse temperature). Our results provide compelling evidence of the role that multiple factors play when learning in self-other conflicting situations.

Talk 3 - Lei Zhang

A Brain-To-Brain Mechanism for Social Transmission of Threat Learning

Survival and adaptation in environments require swift and efficacious learning about what is dangerous. Across species, much of such threat learning is acquired socially, e.g., through the observation of others' ("demonstrators") defensive behaviors. However, the specific neural mechanisms responsible for the integration of information shared between demonstrators and observers remain largely unknown. This dearth of knowledge is addressed by performing magnetoencephalography (MEG) neuroimaging in demonstrator-observer dyads. A set of stimuli are first shown to a demonstrator whose defensive responses are filmed and later presented to an observer, while neuronal activity is recorded sequentially from both individuals who never interacted directly. These results show that brain-to-brain coupling (BtBC) in the fronto-limbic circuit (including insula, ventromedial, and dorsolateral prefrontal cortex) within demonstrator-observer dyads predict subsequent expressions of learning in the observer. Importantly, the predictive power of BtBC magnifies when a threat is imminent to the demonstrator. Furthermore, BtBC depends on how observers perceive their social status relative to the demonstrator, likely driven by shared attention and emotion, as bolstered by dyadic pupillary coupling. Taken together, this study describes a brain-to-brain mechanism for social threat learning, involving BtBC, which reflects social relationships and predicts adaptive, learned behaviors.

Talk 4 - Yulong Huang

Causal Role of the Medial Prefrontal Cortex in Learning Social Hierarchy

Social hierarchy is a fundamental principle of social organization and an important attribute of community stability and development. Yet, little is known about the causal role of specific brain regions in learning hierarchies. Here, using transcranial direct current stimulation (tDCS), we investigated the causal role of the medial prefrontal cortex (mPFC) in learning social and non-social hierarchies. In the Training phase, participants (N=128) acquired knowledge of social and non-social hierarchy in parallel, by trial and error. During the Test phase, they were presented with two items from hierarchies that were never encountered together and required to make transitive inferences. Anodal stimulation over mPFC impaired social hierarchy learning compared with non-social learning and this modulation was influenced by the relative social rank of the members (i.e. higher or lower status). Anodal stimulation also

impaired transitive inference making, but only during early blocks before learning was established. Together, our results provide causal evidence of mPFC engagement in learning social ranks by observation.

Location: Leslokaal 3.2
Symposium 18

Decoding mental states and predicting phenotypes using brain signatures: current advances and challenges

Sebastian Speer, Leonie Koban, Anna Corriveau, Jianxiao Wu

A replication crisis questioned the idea that psychological constructs can be explained by individual brain regions. This promoted the emergence of brain models or “brain signatures”, i.e., distributed brain patterns which predict a mental process or an individual variable and which can be tested across studies. The symposium will present cutting-edge research that leverages brain signatures based on structural or functional MRI (task-based or resting state) to decode mental states (e.g., response to reward during decision-making) or to predict phenotypes (e.g., impulsivity). We will also discuss challenges of brain signatures, in particular the conditions of their generalizability across datasets.

Talk 1 - Sebastian PH Speer, Christian Keysers, Judit Campdepadrós Barrios, Cas JS Teurlings, Ale Smidts, Maarten AS Boksem, Tor D Wager, Valeria Gazzola

A multivariate brain signature predicts reward responses in decision-making tasks

The processing of reinforcers and punishers is crucial to adapt to an ever-changing environment and its dysregulation is prevalent in mental health and substance use disorders. While many human brain measures related to reward have been based on activity in individual brain regions, recent studies indicate that many affective and motivational processes are encoded in distributed systems that span multiple regions. Consequently, decoding these processes using individual regions yields small effect sizes and limited reliability, whereas predictive models based on distributed patterns yield larger effect sizes and excellent reliability. To create such a predictive model for the processes of rewards and losses, termed the Brain Reward Signature (BRS), we trained a model to predict the signed magnitude of monetary rewards on the Monetary Incentive Delay task (MID; $N = 39$) and achieved a highly significant decoding performance (92%). We subsequently demonstrate the generalizability of our signature on another version of the MID in a different sample (92% decoding accuracy; $N = 12$) and on a gambling task from a large sample (73% decoding accuracy, $N = 1084$). We further characterize the specificity of the signature by illustrating that the signature map generates estimates that significantly differ between rewarding and negative feedback (92% decoding accuracy) but do not differ for conditions that differ in disgust rather than reward in a novel Disgust-Delay Task ($N = 39$). We thus created a BRS that can accurately predict brain responses to rewards and losses in active decision-making tasks.

Talk 2 - Leonie Koban, Tor D. Wager, & Hedy Kober**An fMRI marker of food and drug craving**

Craving is a core feature of substance use disorders. It is a strong predictor of substance use and relapse, and linked to overeating, gambling, and other maladaptive behaviors. Craving is measured via self-report, which is limited by introspective access and sociocultural contexts. Neurobiological markers of craving are both needed and lacking, and it remains unclear whether craving for drugs and food involve similar mechanisms. Across three fMRI studies (N=99), we identified a cross-validated neuromarker that predicts self-reported intensity of cue-induced drug and food craving ($p < 0.0002$). This pattern, the Neurobiological Craving Signature (NCS), includes ventromedial prefrontal and cingulate cortices, ventral striatum, temporal/parietal association areas, mediodorsal thalamus, and cerebellum. NCS responses to drug versus food cues discriminate drug users versus non-users with 82% accuracy. The NCS is also modulated by a self-regulation strategy. Transfer between separate neuromarkers for drug and food craving suggests shared neurobiological mechanisms. Future studies can assess the discriminant and convergent validity of the NCS, and test whether it responds to clinical interventions and predicts long-term clinical outcomes.

Talk 3 - Anna Corriveau, Kwangsun Yoo, Young Hye Kwon, Marvin M. Chun, Monica D. Rosenberg**Functional connectome stability and optimality predict cognitive performance**

Leveraging the unique and stable patterns of whole-brain fMRI functional connectivity or connectomes within individuals provides a useful tool for identifying biomarkers of cognitive performance. However, the extent to which an individual's connectome is unique and stable may reflect cognitive and attentional abilities. We tested whether individuals whose connectomes are more similar to themselves over time (stable) and more similar to a group-optimal connectome perform better on cognitive tasks. Further, we tested whether these connectome features explained unique variability in cognitive performance in combination with supervised network-based predictive models. We find that, across three independent samples, individuals with more stable and optimal patterns of connectivity perform better on tasks of sustained attention and working memory, even when controlling for behavioral performance stability. Additionally, measures of connectome stability and optimality improve prediction from network-based connectivity models when generalizing these models to novel tasks. These results suggest that functional connectome stability within individuals and similarity to a task-optimal connectome predict individual differences in cognition. These results also speak to the utility of considering unsupervised models to complement predictions from trained connectome-based models of traits and behavior.

Talk 4 - Valérie Godefroy, Anaïs Durand, Marie-Christine Simon, Bernd Weber, Richard Levy, Bénédicte Batrancourt, Liane Schmidt, Hilke Plassmann and Leonie Koban**A structural brain signature predicts impulsivity in both healthy and clinical samples**

Impulsivity, in particular heightened delay discounting (i.e., higher preference for sooner over later rewards), is a transdiagnostic marker of many psychiatric and neurodegenerative disorders. Our study aimed at identifying a structural brain signature of individual differences in delay discounting in healthy adults, and validating this neuromarker's predictions in patients with behavioral variant frontotemporal dementia (bvFTD)—a neurodegenerative disease characterized by impulsive decision-making. We developed a distributed pattern predictive of the discounting parameter ($\log(k)$) using a cross-validated machine-learning algorithm applied to individual whole-brain grey matter density (GMD) maps. We tested the validity of brain-based predictions first in an independent sample of healthy individuals and second in bvFTD patients matched to controls. We identified a structural brain marker predicting $\log(k)$ with a cross-validated prediction-outcome correlation of $R=0.35$ ($p=0.0028$, $N=117$ healthy adults). Lower GMD in brain regions related to emotions and affect (e.g., anterior insula, dorsal ACC, amygdala) predicted higher discounting (i.e., higher impulsivity). Responses of the obtained brain signature correlated with the urgency component of impulsivity in an independent healthy sample ($R=0.15$, $p=0.047$, $N=166$). Additionally, brain-based predictions separated bvFTD patients ($N=24$) from controls ($N=18$) with 81% accuracy ($p=0.002$), and were associated with higher disinhibition among bvFTD patients ($R=0.52$, $p=0.01$). Thus, individual differences in impulsivity were significantly predicted from whole-brain structure in three independent samples (from both healthy and clinical populations). Future studies can further evaluate the clinical value of the structural brain marker in FTD and other conditions.

Talk 5 - Jianxiao Wu, Jingwei Li, Simon B Eickhoff, Dustin Scheinost, Sarah Genon
Cross-cohort replicability and generalizability of brain connectivity-based behavior prediction

An increasing number of studies have aimed to predict interindividual differences in behavioral phenotypes based on interindividual differences in resting-state functional connectivity. In addition, many studies have attempted to infer brain-behavior associations by interpreting the machine learning models employed for prediction. However, the replicability and generalizability of brain-behavior associations identified by such efforts remains an open question. To this end, we examined the cross-dataset replicability and generalizability of brain-behavior association patterns for fluid cognition and openness predictions, where the association patterns are derived using a previously developed region-wise approach. Overall, we found moderate similarity in patterns for fluid cognition predictions across cohorts, especially in the Human Connectome Project Young Adult, Human Connectome Project Aging, and Enhanced Nathan Kline Institute Rockland Sample cohorts, but low similarity in patterns for openness predictions. Furthermore, we assessed the generalizability of prediction models in cross-dataset predictions, by training the model in one dataset and testing in another. Making use of the region-wise prediction approach, we showed that first, a moderate extent of generalizability could be achieved with fluid cognition prediction, and that, second, a set of common brain regions related to fluid cognition across cohorts could be identified. Nevertheless, the moderate replicability and generalizability could only be achieved in specific contexts. Thus, we argue that

replicability and generalizability in connectivity-based prediction remain limited and deserve greater attention in future studies.



May 24th – 9:00AM – 10:00AM

KEYNOTE TALK

Friday, May 24th 2024 // 9:00am - 10:00am

Location: Auditorium 2

Keynote lecture 2

Towards a holistic approach to human decision making

Soyoung Q Park,

Nutrition Neuroscience at the Charité, Universitätsmedizin Berlin, Germany

What drives us to trust someone we just met? Did we eat spaghetti for lunch because we saw our colleague eat spaghetti? Can our breakfast impact our decisions throughout the day? I propose to view decision neuroscience as a highly interactive interdisciplinary research field, since we need to continuously integrate internal and external information to make and modulate decisions. On the one hand, I will present how decisions emerge as a result of intense body-brain interactions, exemplified by how the food we have eaten can change our decisions via metabolic pathways. On the other hand, our decisions are shaped by the constant integration of social information around us. In this talk, I will present a series of recent studies from my lab in which we shed light on the importance of the holistic nature of decision neuroscience, including metabolic and social aspects.



May 24th – 10:30pm – 12:00pm

SYMPOSIA

Location: Auditorium 2
Symposium 19

Gut-Brain Interaction shaping decisions

Soyoung Park

The multidirectional interplay between the brain and the gut has captured increased attention in last decades. This symposium assembles researchers to decode the interactions among the brain and gut to unravel multiple mechanisms shaping human behavior, cognition and decisions. This symposium will delve into latest advances in research such as the metabolic regulation of central neurotransmitter systems, the impact of metabolic states (diet, weight loss, hunger) and hormonal dynamics on cognitive and brain functions. This symposium will foster cross-disciplinary discussions between the fields to understand the gut-brain interactions.

Talk 1 - Min Pu, Lu Liu, Sergio Oroz Artigas, Anja Ulrich, Jeremy Tardu, Britta Wilms, Berthold Koletzko, Sebastian M. Schmid

Insulin gates the serotonergic brain functions in humans

Recent mouse models suggest insulin directly modulates the serotonergic brain system and contributes to the development of mood disorders, a common comorbidity of metabolic abnormality, such as obesity and diabetes. However, limited research has investigated the neuro-metabolic mechanism in humans. We hypothesized that insulin sensitivity regulates serotonergic brain functions, as well as risk behavior in humans. Here, thirty-two (age, 23.85 ± 3.20 years) healthy male participants were offered meals with high/low carbohydrate/protein ratios to examine changes in the risk decision task while assessing metabolic and neural activity. We hypothesized that the risk-sensitive region reflects tryptophan dynamics, which is modulated by insulin sensitivity. Firstly, we identified that brain activation changes, particularly in the superior parietal lobule, induced by high carbohydrate/protein meal were spatially correlated with the distribution of serotonin transporter densities. At the functional level, insulin resistance moderates the association between plasma tryptophan fluctuation and serotonergic brain functions in the superior parietal lobule. Specifically, plasma tryptophan fluctuation was positively associated with the parietal activity at low insulin resistance levels, which vanished at high insulin resistance levels. Secondly, we showed that individual differences in tryptophan are reflected with gray matter volume of the superior parietal lobule. These findings highlight the translation of animal findings of how insulin resistance regulates central serotonin functions in humans. Our study emphasizes that impaired insulin sensitivity may blunt the serotonin system and thereby impact mood behaviors, such as the prevalence of depression in individuals with type 2 diabetes.

Talk 2 - Beatrix Keweloh, Damiano Terenzi, Eva Froehlich, Alexia Beckmann, Matthias Laudes & Soyoung Q. Park

Weight Loss Impacts Risky Decisions in Obesity

Risk decision-making is shaped by individual psychological and metabolic state. Individuals with obesity show not only changed risk behavior, but also metabolic and psychological abnormality. We hypothesized a substantial weight loss in obesity will 1) normalize the metabolic and psychological state and 2) will change their pattern of decision guidance. To investigate this, we assessed the effect of HbA1c and mood on risk behavior in individuals with obesity (n=62, 42 women; BMI, 46.5 ± 4.8 kg/m²; age, 44.9 ± 14.7 years) before and after 10-week weight loss intervention. The intervention reduced risky behavior, which was significantly predicted by changes in BMI. Before intervention, mood, but not HbA1c significantly predicted decisions. After the weight loss, mood no longer, but HbA1c significantly predicted decisions. Our findings shed light on the psychological and metabolic mechanisms underlying altered risky decision-making in severe obesity and can inform the development of strategies in the context of weight loss interventions.

Talk 3 - Arasch Mostaufi & Stefanie Brassen

Metabolic-cognitive control of food choices

Long-term weight loss maintenance is the major challenge in obesity treatment and critically depends on the control of hedonic eating. We have previously established that central insulin action in mesolimbic pathways plays a critical role in hedonic food valuation under normal and pathological conditions. However, eating behavior also depends on cognitive control, as has been shown, for example, in restrained eaters or successful dieters. There, neuroimaging studies have identified prefrontal pathways that modulate value computation signals to incorporate health information into food choices. Given the availability of insulin receptors throughout the brain, it can be speculated that central insulin may also influence prefrontally mediated inhibitory control of food intake, which would represent a crucial mechanism for reduced food control observed in obese patients who typically exhibit insulin resistance. To answer this question, we extended our previously established intranasal insulin fMRI approach to an individualized food choice task that manipulates self-control by directing participants' attention to short-term (i.e. taste) and long-term (i.e. healthiness) stimulus characteristics. This allows the disentanglement of metabolic and cognitive reward regulation within a single run and thus the extraction of independent, common and interactive (e.g. compensatory) processes. In this talk we will present behavioral and neural results from 40 healthy participants who underwent this randomized, controlled, cross-over design including pharmacological fMRI.

Talk 4 - Jennifer March

Attentional and health valuation shifts drive poor dietary choice under hunger

Hunger is a biological drive, with the function of motivating a mechanism to eat to reach homeostasis. Under hunger participants are particularly likely to look at and choose

hedonic food options. Yet, the cognitive mechanisms that describe hunger-driven effects on attention and dietary choice remain elusive. To fill this gap, 70 participants completed a binary food choice task in hungry and sated states (within-subject design) while their eye-movements were being recorded. The considered attributes of the binary options were taste and health as represented by food images and corresponding nutritional scores, respectively. Confirming our preregistered hypotheses, participants were more likely to choose tasty over healthy food items, and this difference was amplified by hunger state. Notably, attention emerged as a pivotal mediator in this relationship. To understand the mechanism driving behavioral effects, we modeled decision dynamics with Drift Diffusion Models (DDM) and compared different DDMs of varying complexity. We show that DDMs taking attention into account, specifically the multi-attribute attentional DDM with starting point bias, best predicted our behavioral results. This model suggests that while participants' taste weights remain similar in both conditions, hungry participants do not consider health information when choosing between food options. Together with our mediation analysis, our modeling results suggest that poor dietary choices under hunger are driven by an attentional shift as well as an impairment in health consideration in the decision process.

Talk 5 - Sharmili Edwin Thanarajah

Impact of western diet on reward signaling in humans

Overweight and obesity are leading causes of a number of somatic and psychiatric diseases worldwide. In particular, processed foods with a combination of high fat and sugar content are associated with the development of the obesity pandemic. Foods with a high fat and sugar content activate reward-associated areas in the brain. Using positron emission tomography, we were able to demonstrate that these foods lead to a release of dopamine in the brain directly through taste and postprandially - presumably mediated by signals from the intestine. This dopamine signal is directly associated with the subjective preference for the food. Foods high in fat and sugar are strongly favored over foods that are only high in fat or only high in sugar. This is accompanied by an increased activation of reward-associated areas in functional magnetic resonance imaging. Furthermore, in a randomized controlled trial, we demonstrated that a high-fat and high-sugar dietary intervention over eight weeks in healthy, normal-weight subjects increased activation in reward-associated and sensory-integrative brain areas and decreased preference for low-fat foods, independent of weight gain. Through this mechanism, high-fat and high-sugar foods could increase the excessive consumption of these same foods and promote the development of obesity. Only by understanding these mechanisms will we be able to prevent and sustainably treat the development of obesity and its consequences for the brain.

*Location: Auditorium 4
Symposium 20*

How the way we move shapes social perception and interaction

Lucia Sacheli, Marlene Meyer

Other people's movements provide powerful cues to navigate the social world. By observing others' actions, we infer their mental states and learn new motor and social skills from them. The way we move is also critical when we have to coordinate to achieve a goal together, and interpersonal adaptations are required on a millisecond timescale. The symposium will discuss open questions on how, in infants and adults, minimal kinematic cues allow us to infer others' intentions, learn new information, and better coordinate social exchanges. Seemingly contrasting results between observation and coordination contexts will be discussed to provide a comprehensive view.

Talk 1- Joanna Rutkowska

The precursor of action prediction in infancy: the sensitivity to intention information encoded in others' movement kinematics

Predicting others' actions is crucial part in social interactions. To use movement kinematics for action prediction, one has to separate the small fraction of variability that carries the prospective information about the next action out of the overall variability in the movement. Adults have a rapid, implicit access to this vital information, suggesting there is a neurocognitive mechanism that enables its detection from others' movement kinematics. This pre-registered study investigated whether infants are equipped with such a mechanism that enables them to detect prospective information from others' movement kinematics. We tested a large sample (N=147) of 14-month-olds using a habituation paradigm designed to examine whether they discriminate between grasping movements performed with different intention. Infants watched unique videos of actors grasping a bottle with one of the two intentions: grasp-to-drink and grasp-to-pour. Once they habituated, they were presented with two videos of grasps performed with either the same, or different, intention than before (between-subjects). We found strong evidence that infants who saw movements with different intention in the first test trial looked longer towards them than infants who saw movements with the same intention. Using a novel methodological approach, we show that this effect was driven by the differences encoding the intention in movement kinematics of the last movements infants saw during habituation, and the movement they saw in the test trial. These results demonstrate that infants are specifically sensitive to the variability in others' movement kinematics that encodes intention information, whilst discarding the larger portion of uninformative variability.

Talk 2 - Marlene Meyer

Surprise in others' movements modulates infants' brain activity

How do infants learn about new actions from others? When demonstrating new actions to their infants, parents tend to exaggerate their movements (van Schaik et al., 2020). Importantly, such infant-directed actions enhance infants' attention to the action (Brand & Shallcross, 2008) and facilitate infants' action learning (Brand et al., 2002). Yet, how do infant-directed actions capture infants' attention? We investigated this question in an electroencephalography (EEG) study with 15-month-olds, specifically examining the hypothesis that variability in movement amplitude rather than larger movements alone attracts infants' attention. In a within-subjects design, we manipulated whether an action was presented either with movements of normal, high or varied amplitude. Theta band activity in frontal brain regions has been linked to attention and memory (Clayton et al., 2015) and is thought to reflect infants' learning of new information (Begus et al., 2015). To investigate how the different conditions affected infants' neural processing, we compared theta power (4-5Hz) in fronto-central channels between conditions. Theta power was significantly higher, indicating stronger attentional engagement, in the variable compared to the other conditions. With computational modelling we subsequently extracted information theoretic surprise contained in the variable movements. Notably, infants' frontal theta power was predicted by how surprising each movement was. The temporary increase in processing at surprising moments may lead to more robust encoding and memory formation. All in all, surprise induced by variability in movements rather than large movements alone engaged infants' attention. This offers insights into the brain mechanisms at play when infants process others' actions.

Talk 3 - Lucia Sacheli

Leading and following interaction success: the neurophysiological signatures of sensorimotor communication during a coordination task

Social interaction often entails partners playing different roles, like in pair dancing, when the leading partner uses hand pressure to guide the mate, whose task is to quickly get the conveyed message and complete the choreography. Role-taking is essential when there is an asymmetry in information distribution between interacting agents, and one has to provide essential cues to the other to solve the coordination task. In these cases, agents resolve to sensorimotor communication (SMC) and carve their movement kinematics to communicate knowledge to the partner. Although the emergence of sensorimotor communication has been repeatedly shown at the behavioral level, evidence of its neurofunctional underpinnings is lacking. Here, pairs of participants (one lying in the MRI scanner and one playing in an adjacent room) played a visuo-motor task and moved two cursors on the screen to synchronously reach one of two possible targets. Participants took turns playing the role of the Leader, i.e., being the one who chooses which of the two targets must be reached. When playing as Leaders, participants showed faster reaction times, lower velocity peaks, and less variable trajectories, and they showed stronger recruitment of the dorsolateral prefrontal cortex bilaterally, suggesting a cognitive effort while leading, and of the left frontal operculum and superior temporal gyrus involved in others' action encoding. On the contrary, fronto-parietal and cerebellar brain regions responsible for action

prediction were equally recruited when playing as Followers. The relevance of these results for our understanding of the neurophysiological bases of SMC will be discussed.

Talk 4 - James P. Trujillo

Differences in Interaction-Partner Empathy are Associated with Interpersonal Kinematic Similarity but not Prosodic Similarity During Conversation

During interaction, speakers coordinate and synergize their movement at multiple levels, and in different ways., even without any explicit instruction to do so. The extent to which two individuals entrain their movements to one another during interaction may depend on how similarly or differently they engage with the world (i.e., the Double Empathy Problem). In this study, we examined whether interpersonal differences in empathy quotient scores is associated with interpersonal entrainment of two of the most prominent communicative articulators: the head and hands. Using a corpus of unconstrained, dyadic conversation, we applied dynamic time warping to quantify similarity of head and hand motion, and differences in maximum speech f_0 , during questions-response sequences. We additionally calculated differences in empathy quotient (EQ) scores. We found that, for both the head and hands, greater difference in EQ was associated with higher kinematic entrainment. I discuss how these results inform the role of movement in conversation, and more broadly how movement can capture high-level aspects of how personality trait differences can be seen in the dynamics of interaction.

*Location: Auditorium 1
Symposium 21*

The formation and modulation of empathy in the brain

Yoni Levy, Grit Hein

The past two decades have seen the apparition of the study of “empathy neuroscience”: investigating the neural substrates, mechanisms and systems involved in various forms of empathy. In this symposium, five talks will elaborate on the formation and modulation of empathy in the brain. Using a myriad of state of the art methods: hyperscanning-EEG, neurofeedback, neuro-computational modelling, MEG, fMRI, neurophenomenology and pharmacology – the symposium will reveal new perspectives on formation during development and prediction-errors, as well as its modulation through opioid administration, politics and neurofeedback.

Talk 1 - Simone Shamay-Tsoory, Mario Francis

Interbrain plasticity underlies regulation of empathy

Empathy is a critical aspect of emotional well-being, yet attempts to enhance this capacity have seen limited success. Recent research has unveiled associations between empathy and inter-brain coupling, measuring the synchronization of neural signals between individuals interacting. However, the underlying mechanisms and the potential for increasing such coupling remain uncertain.

In our initial study, we identified brain regions that exhibit interbrain coupling during empathic interactions, highlighting the coupling between participants' right inferior frontal gyrus (rIFG) during empathy. In the subsequent phase, we developed a novel technology that delivers real-time feedback to two interacting participants, enabling them to influence their inter-brain coupling.

Our central research question examined whether dyadic neurofeedback training can durably increase inter-brain coupling and, subsequently, individuals' empathy. To address this, we designed and developed the neurofeedback platform, validating its initial effectiveness in enhancing inter-brain coupling. Subsequently, we conducted an experiment that ascertains the replicability of these enhancements and examined changes in empathy following training.

Through this multifaceted approach, our study seeks to shed light on the potential of dyadic neurofeedback training to increase brain-to-brain coupling and enhance empathy. The findings from these experiments hold the promise of advancing our understanding of the neural underpinnings of empathy and developing effective interventions to improve empathy and promote emotional well-being.

Talk 2 - Grit Hein , Anne Saulin, Yuqing Zhou

Learning Empathy

Learning to adapt social motivation and behaviors is crucial in changing environments. However, the underlying computational and neural mechanisms remain poorly understood. Here we present two exemplary studies that apply computational reinforcement learning models to investigate the learning-related plasticity of empathy (i.e., the ability to share others' emotional states) and empathy-related social closeness. A first study examines the social transmission of empathy across individuals. We show that individuals change their behavioral and neural empathic responses when they observe empathic or non-empathic reactions of others, based on observational prediction errors. A second study focused on the formation and stability of empathy-related social closeness. Using an acquisition-extinction paradigm, we find that prediction-error learning accounts for individual differences in empathy-related closeness and its stability in the absence of empathy-inducing events. Taken together, the presented research highlights the potentials of computational modelling approaches for explaining the plasticity of social motivation and resulting behaviors.

Talk 3 - Julia Braunstein, Rütgen, M., Diendorfer, C., Willeit, M., Lamm, C.

The role of the opioid system in pain empathy and prosocial behavior.

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. Furthermore, in a prosocial helping task, placebo analgesia also reduced the amount of effort participants were willing to exert in order to reduce the pain of another person. Reduced pain empathy accounted for the observed differences in prosocial behavior. Although the analgesic effects of placebo induction are thought to be mediated via the release of endogenous opioids, there still remains the possibility that these observed effects could have been driven by participant's expectations and beliefs about the administered substance. To circumvent the unspecific effects of placebo analgesia and eliminate expectancy effects we employed a double-blind within-subject design with opioid administration. In my talk I will present the results of this study and discuss potential implications.

Talk 4 - Jonathan Levy

The neural development of empathy

Empathy is a social-cognitive process that operates by relying mainly on the suppression of the cortical alpha rhythm. This phenomenon has been repeatedly evidenced in adult human subjects, yet, recent neurodevelopmental studies indicated that at a younger age, empathy involves reversed brain responses (e.g., alpha enhancement patterns). In this multimodal study, we capture neural activity at the

alpha range (MEG session), and hemodynamic response (fMRI session) and target subjects at approximately 20 years old as a unique time window in development that allows investigating both low-alpha suppression and high-alpha enhancement. MEG revealed that the alpha pattern shift during empathy happens in an all-or-none pattern: power enhancement before 18 and suppression after 18 years of age. Additionally, MEG and fMRI highlight a correspondence between high-alpha power increase and blood-oxygen-level-dependent (BOLD) decrease before 18, but low-alpha power decrease and BOLD increase after 18. Importantly, this neurodevelopmental transition was not revealed by four other measures: self-reported (a) ratings of the task stimuli, (b) ratings of naturalistic vignettes of vicarious pain, (c) trait empathy, or neural data from (d) a control neuroimaging task. Findings suggest that at the critical age of around 18, empathy is underpinned by an all-or-none transition from high-alpha power enhancement and functional inhibition to low-alpha power suppression and functional activation in particular brain regions, possibly indicating a marker of maturation in empathic ability. This work advances a recent neurodevelopmental line of studies and provides insight into the functional maturation of empathy at the coming of age.

Talk 5 - Eliyahu Adler, Niloufar Zebarjadi, Annika Kluge, Jonathan Levy

Empathy and Political Ideology: Is there any relationship between the two?

The study of ideological asymmetries in empathy has consistently yielded inconclusive findings. Yet, until recently these inconsistencies relied exclusively on self-reports, which are known to be prone to biases and inaccuracies when evaluating empathy levels. In a first study (N = 56), we find ideological asymmetries in cognitive-affective empathy while relying on neuroimaging for the first time to address this question. In a second study which sampled a large cohort of individuals (N = 125) from two distant countries and neuroimaging sites, we re-examine this question, but this time from the perspective of empathy to physical pain. The results are unambiguous at the neural and behavioral levels and showcase no asymmetry. In a third behavioral study (N = 296) which employed virtual reality as a perspective taking intervention, we found an effect on rightist participants and not on leftists. Together, these studies raise a novel premise: the question of whether empathy and its regulation are ideologically (a)symmetrical depends on the targeted component of empathy (e.g., physical pain vs cognitive-affective), and may require explicit but also unobtrusive techniques for the measure of empathy.

Location: Leslokaal 1.2
Symposium 22

Neurobehavioral insights through cognitive and affective tasks in psychiatric patients receiving deep brain stimulation

Laura Luyten, Hemmings Wu, Bryan Strange

In contrast with rodent researchers, human mental health researchers only rarely get the chance to directly and focally manipulate deep brain areas. Deep brain stimulation (DBS) does offer this opportunity, and combined with tailored cognitive and affective tasks, can provide truly novel insights in the function of the targeted brain region, in the working mechanisms of DBS, as well as in the etiology of the disorder that the patient is being treated for with DBS. This symposium will highlight recent advances using this approach in patients suffering from treatment-resistant obsessive-compulsive disorder and depression, and receiving DBS in various brain targets.

Talk 1 - Laura Luyten

Behavioral approaches to guide optimization of deep brain stimulation in the bed nucleus of the stria terminalis for obsessive-compulsive disorder

Deep brain stimulation (DBS) is an emerging therapy for treatment-resistant obsessive-compulsive disorder (OCD), a psychiatric disorder characterized by anxiety-provoking thoughts and crippling rituals. Several targets for DBS electrode implantation in OCD have been proposed. I will discuss the evidence that we currently have to target the bed nucleus of the stria terminalis (BST), a region that has not been typically implicated in OCD neurocircuitry, but does appear to be involved in responding to uncertain threats. Combining preclinical DBS research in rats and clinical DBS trials in humans, we are starting to delineate its role in OCD, and in anxiety more generally. In several clinical trials, we have found significant therapeutic effects of BST stimulation in OCD. In a recent, double-blind, randomized symptom provocation study, we have compared the acute effects of left/right/bilateral BST stimulation. We found no differences between uni- and bilateral stimulation, but we did find indications that stimulation in the BST was beneficial for patients who had achieved unsatisfactory effects through the trial-and-error electrode contact selection procedure that is typically used in clinical practice. Using a standardized symptom provocation task in combination with precise anatomical target selection may hold promise to optimize DBS as a treatment for OCD. In ongoing research, we are further embracing this approach, and complementing it with noninvasive (EEG) and invasive (electrophysiological recordings) techniques, as well as extending it with other tasks (e.g., fear conditioning) that aim to chart the role of the BST in responding to uncertain threats in our OCD patients.

Talk 2 - Hemmings Wu

The opposing effects of esketamine on different neural clusters in the lateral habenula and their implications for deep brain stimulation

Deep brain stimulation (DBS) of the lateral habenula (LHb) has been proposed as a treatment option for treatment-resistant depression (TRD), but the effects found in previously published clinical studies remained suboptimal. Esketamine is a novel drug treatment for TRD reported to have its antidepressant effect potentially via LHb. Here, we explored different stimulation strategies based upon the electrophysiological effects induced by esketamine on LHb.

First, we found in mice that there may be multiple groups of neural clusters in the LHb, some highly activated, while others substantially deactivated after esketamine injection. We next performed intraoperative micro-electrode recording in the LHb in a TRD patient receiving DBS in this brain area. Simultaneously, a series of behavioral tasks, including baseline resting state, a monetary reward omission task, and image-induced emotional response were employed, followed by intravenous esketamine infusion. Based on these findings, we proposed high- (130 Hz), low- (20 Hz), and dual-frequency (130 and 20 Hz) stimulation paradigms for LHb DBS for TRD. Hamilton Depression Rating Scale scores improved significantly in all three stimulation conditions (from 20 at baseline evaluation to <10 with DBS), while different aspects of symptom improvement were observed when different stimulation paradigms were applied.

Our findings show that esketamine has opposing effects on different neural clusters in the LHb and that an antidepressant effect is achieved with DBS in this area. Nevertheless, a higher spatial resolution with cluster specificity may be warranted to reach the full potential of LHb neuromodulation for TRD.

Talk 3 - Bryan Strange

Deep brain stimulation of the human nucleus accumbens-medial septum enhances memory formation

Deep brain stimulation (DBS) is a potential novel treatment for memory dysfunction. Current attempts to enhance memory focus on stimulating human hippocampus or entorhinal cortex. However, an alternative strategy is to stimulate brain areas providing modulatory inputs to medial temporal memory-related structures, such as the nucleus accumbens (NAc), which is implicated in enhancing episodic memory encoding. Here, we show that NAc-DBS improves episodic and spatial memory in psychiatric patients. During stimulation, NAc-DBS increased the probability that infrequent (oddball) pictures would be subsequently recollected, relative to periods off stimulation. In a second experiment, NAc-DBS improved performance in a virtual path-integration task. An optimal electrode localization analysis revealed a locus spanning postero-medio-dorsal NAc and medial septum predictive of memory improvement across both tasks. Patient structural connectivity analyses, as well as NAc-DBS-evoked hemodynamic responses in a rat model, converge on a central role for NAc in a hippocampal-mesolimbic circuit regulating encoding into long-term memory. Thus, short-lived, phasic NAc electrical stimulation dynamically improved memory, establishing a critical

online role for human NAc in episodic memory and providing an empirical basis for considering NAc-DBS in patients with loss of memory function.

Location: Leslokaal 1.3
Symposium 23

Exploring complex brain mechanisms underlying maladaptive emotion regulation through advanced neuroscience techniques

Chris Baeken, Stefanie De Smet

This symposium presents novel insights into neural mechanisms underlying maladaptive emotion in psychiatric disorders. Chanyu Wang will discuss abnormal dynamic functional connectivity in high ruminators. Quinyuan Chen will elaborate on adolescent brain responses to criticism, identifying vulnerability markers for depression. Yichen Zhang will discuss altered microstructural properties in major depression, emphasizing the role of white matter in emotional regulation and cognitive control. Finally, Paula Horczack will introduce a clinical pilot protocol that investigates electrical stimulation combined with cognitive behavior therapy for rumination. These diverse approaches shed light on the intricate neural underpinnings of emotional dysregulation in psychiatric conditions.

Talk 1 - Chanyu Wang

Abnormal dynamic functional connectivity of the sgACC in individuals with high levels of repetitive negative thinking

The subgenual anterior cingulate cortex (sgACC) plays an important role in emotion regulation such as in coping with anxiety and depression. Rumination and worry share the underlying process of relatively uncontrollable repetitive negative thinking (RNT). However, patients with RNT often show both depressive and anxiety symptoms and it is currently unclear whether sgACC involvement is specific for anxio-depressive symptoms and what role sgACC lateralization may play. We compared resting-state dynamic functional connectivity (dFC) in patients suffering from RNT (RNT group, $n = 50$) and healthy controls (HC group, $n = 46$) using left and right separately, as well as the entire sgACC, as the seeds. The left sgACC shows decreased dFC with the left middle occipital gyrus, the right superior occipital gyrus, and the right precuneus in the RNT group compared to the HC group. However, only decreased dFC between the left sgACC and the left middle occipital gyrus shows a significant correlation with worry but not with ruminative thinking. The aberrant dFC observed between the left sgACC and the left middle occipital gyrus in these anxio-depressive cohorts may represent the visualization of catastrophizing which is a hallmark of worrying about something that has not happened yet and might not happen at all. This suggests that patients with RNT who have a more reduced variability in connectivity between the left sgACC and the left middle occipital gyrus may be more prone to worry, but not to rumination.

Talk 2 - Quinyuan Chen

Unraveling how the adolescent brain deals with criticism: a Dynamic Causal Modeling study

Sensitivity to criticism is considered a risk factor for the development of psychiatric disorders in adolescents, who may be more vulnerable to negative social evaluation and exhibit inadequate emotion regulation such as rumination. The neural network involved in dealing with criticism in adolescents may serve as a biomarker for vulnerability to depression. In this study, 64 healthy adolescents (aged 14 to 17 years) were asked to listen to a series of self-referential auditory segments, which included criticism, praise, and neutral conditions, during fMRI scanning. Dynamic Causal Modeling (DCM) was performed to quantify the modulatory effects of exposure to criticism and praise on the effective connectivity between three brain regions: the left pregenual anterior cingulate cortex (pgACC), the left dorsolateral prefrontal cortex (DLPFC), and the right precuneus (preCUN). We found that adolescents who are more sensitive to criticism showed less inhibition of the preCUN-to-DLPFC connectivity when being criticized, indicating that they required more engagement of the DLPFC to sufficiently disengage from negative self-referential processing. Furthermore, the inhibitory connectivity from the DLPFC to the pgACC was strengthened by exposure to praise as well as criticism, suggesting a recruitment of cognitive control over emotional responses when dealing with positive and negative evaluative feedback.

Talk 3 - Yichen Zhang

Altered microstructural properties of superficial white matter bundles connecting regions implied in emotional regulation and cognitive control in major depressive disorder

Major depressive disorder (MDD) is a severe psychiatric illness marked by impaired emotional and cognitive functioning. Previous diffusion tensor imaging (DTI) studies have focused primarily on the long-range white matter bundles within the deep white matter (DWM) that connects pairs of distant cortical regions. Such studies have revealed DTI abnormalities in DWM tracts that are integral to emotional regulation and the reward system, including the corpus callosum (CC), anterior corona radiata (ACR), cingulum bundle (CB), superior and inferior longitudinal fasciculus. However, less is known about the DTI metrics of the superficial white matter (SWM), which consists of short association bundles connecting adjacent cortical regions in MDD patients. To investigate SWM abnormalities in MDD patients, we studied 62 MDD patients and 77 healthy controls (HC). We found that the MDD patients compared to HC displayed significantly lower fractional anisotropy (FA) and higher mean diffusivity (MD) in the SWM bundles connecting cortical regions involved in emotional regulation and cognitive controls. In addition, because variations in neurite density or orientation dispersion may underlie these DTI metric changes. We also employed neurite density index (NDI) and orientation dispersion index (ODI) derived from the NODDI model in the SWM. We found that the different NODDI metrics changes were related to different cortical regions. Our findings suggest that disruptions in the short association fibers connecting key areas responsible for emotional and cognitive processing may form the structural basis for the emotional and cognitive impairments observed in individuals with MDD.

Talk 4 - Paula Horczack

Combining tDCS with group CBT developed to treat rumination: A clinical pilot study

As part of repetitive negative thinking (RNT), rumination is a maladaptive cognitive response style to stress or negative mood which can increase the risk of depression and may prohibit complete recovery. Cognitive behavioral therapy (CBT) and transcranial direct current stimulation (tDCS) both proved to be effective in decreasing rumination. However, the combined effects of tDCS and CBT interventions on rumination have not yet been explored. The first aim of this pilot study is to investigate whether the combination of tDCS and CBT has an accumulating positive effect on modulating state rumination. The second aim is to assess the feasibility and safety profile of the proposed combined approach. Seventeen adults suffering from RNT participated in an 8-week group intervention for RNT comprising 8 sessions of CBT. Before each CBT session, patients were primed with one double-blinded prefrontal active or sham tDCS combined with an internal cognitive attention task focused on individual RNT. During each session, the Brief State Rumination Inventory was used to assess state rumination. A mixed effects model analysis revealed no significant differences between the stimulation conditions, weekly sessions or their interaction in terms of state rumination scores. Overall, the combination of online tDCS priming followed by group CBT was found to be safe and feasible. On the other hand, no significant additional effects of this combined approach on state rumination were established.

Location: Leslokaal 3.2
Symposium 24

Representing Outgroup Minds

Min Pu, Zoe Pounder, Bryony Payne, Rosamunde Hendricks, Caroline Catmur

This symposium explores the neural and cognitive mechanisms through which humans represent the minds of others, especially those who are unlike themselves or are members of an outgroup. We start by investigating how individuals build models of others' minds through learning about their traits, and how the brain responds when these traits are inconsistent with stereotypes. Next, we consider how humans learn to empathise with others who are dissimilar from the self; and how individuals can improve their ability to understand politically dissimilar others. Finally, we will discuss the neural correlates of political polarisation and out-group exclusion.

Talk 1 - Min Pu

Changing our minds: the mentalizing network of the cerebellum and cerebrum contributes to detecting inconsistent trait behaviors.

To navigate in a complex human society, people make inferences about the minds of other people, termed social mentalizing. The cerebellar internal model contributes to dynamic social cognition by encoding sequences of actions and identifying the violations when these actions deviate from our expectations. This study aims to investigate cerebellar and cerebral involvement in detecting inconsistent actions that violate the implied trait. Participants were required to memorize the temporal order of a set of sentences that implied a personality trait of an individual. Importantly, the sentence sets were designed in such a way that the first half of each set involved actions that were consistent with the expected trait, while the other half was either consistent or inconsistent with the expected trait. As hypothesized, we found robust activations in the mentalizing network of the cerebellum and cerebral dorsomedial prefrontal cortex (dmPFC) when memorizing the order of the actions, but more crucially also for actions implying an inconsistent trait in comparison to consistent trait actions. Furthermore, during social violations, we established significant effective connectivity between the cerebellar crus and cerebral dmPFC using dynamic causal modeling. These findings support the hypothesis that the mentalizing areas of the cerebellum and cerebrum are involved in social sequencing learning, as well as high-level prediction of trait implications of those actions.

Talk 2 - Zoe Pounder

Empathy for dissimilar others: learning to feel empathy for out-groups.

Society is becoming more polarised and there is a growing need to understand how we can better empathise with one another. It has been theorised that empathy is enabled by genetically-specified links between perceivable states of the other (e.g. facial expressions) and sensory/affective states of the self. Any such genetic predispositions should limit the opportunity for social learning of empathy, but the extent of such limits remain unclear. The current study investigated the effectiveness of different forms of social learning to explore whether these can modulate existing empathic processes. In particular, whether such learning can instantiate empathy for an artificial alien species (that do not have human-like features) and for whom we cannot have any genetically-specified systems for interpreting their emotion. To induce empathy, participants learned about these artificial alien agents during a training phase, across several independent conditions: direct observation, vicarious learning, learning with symbolic information and learning through explicit language with regards to the aliens' state. These conditions were compared to a control condition, whereby participants viewed the artificial agents during training in the absence of additional information. The results suggest that learning about the alien's state through language is the most effective form of social learning to evoke empathy.

Talk 3 - Bryony Payne

Understanding in-group and out-group minds: How to better understand politically dissimilar others.

Understanding others, such that we can infer their mental states, is an important part of social interaction. People are less able to accurately infer the views of out-group members – especially those they politically disagree with – relative to in-group members. However, they are unaware of their differential performance, i.e. people report similar levels of confidence in their ability to infer the mental states of both groups (Payne, Bird, & Catmur, in prep). This is underpinned by a poorer, less accurate representation of out-group members, which gives rise to inaccurate inferences about the views they hold. This poorer representation is also evident in the homogeneity effect by which people judge out-groups to be more homogenous than they really are and, as a consequence, tend to overestimate the extremity of out-group views, representing only the extremes of the out-group. Here, we assess which factors could improve people's representation of out-groups and so their ability to understand out-group minds. For instance, does getting feedback about the (in)accuracy of one's inference help to improve understanding? Does becoming more aware of the heterogeneity within the out-group, i.e. the variability between out-group views, help people to better understand individuals within that group? We demonstrate that both heterogeneity training and feedback are effective in improving accuracy and awareness of mental state inference for out-group minds.

Talk 4 - Rosamunde Hendricks

When the political becomes personal: The neural effects of political exclusion.

Violent extremism is a persistent concern in Western societies, with social exclusion often identified as a driving force behind it. In the violent extremism literature, personal

experiences of exclusion are often conflated with perceptions that one's political group is socially and economically isolated (political exclusion). Thus, it is unclear how political exclusion relates to personally experiencing ostracism, and whether it can promote violent extremism in the same way personal exclusion does. To explore these processes, a cohort of 60 individuals resident in Spain participated in a functional neuroimaging experiment. Participants engaged in two experimental paradigms while lying in the scanner. The first task was a Cyberball game, a ball-tossing game designed to induce feelings of exclusion. The second paradigm is a newly developed social exclusion paradigm (RateME) which allows to make a clear distinction between personal and political exclusion. In it, participants receive ratings of their own profile (personal exclusion) or their country (political exclusion) in a group setting. We expect to find similar neural correlates in response to both personal and political exclusion, especially in brain areas associated with social pain, such as the anterior cingulate cortex (ACC) and the right ventral prefrontal cortex (RVPFC). These effects should be stronger among individuals who highly identify with their country. This investigation examines the neural and psychological similarities and differences between personal and political exclusion. The results will clarify whether political exclusion, similar to personal exclusion, should be examined as a risk factor for violent extremism.



May 24th

POSTER SESSION 2



Location: Cafeteria

Poster 1

Multiple paths to rumination: A network analytical approach

Gerly Tamm, Ernst Koster, Kristof Hoorelbeke

Theories of rumination have proposed different psychological factors to place one at risk for repetitive negative thinking. An empirical test that captures the most relevant contributors to rumination within one integrative model is lacking. Building on influential self-regulatory and metacognitive frameworks, we modeled how key constructs in this context relate to ruminative thinking. 498 participants completed online questionnaires including indicators of rumination, metacognition, promotion goal orientation, effortful control, and depression. We estimated regularized partial correlation networks to investigate the general structure of the integrative model and followed these analyses up with directed acyclic graphs to identify potential causal pathways towards rumination. Results demonstrated that: (1) both self-regulatory and metacognitive factors were directly linked to rumination, amongst these were (2) positive beliefs, negative beliefs about uncontrollability, self-consciousness, depression, and effortful control, and (3) we identified multiple potentially causal pathways, suggesting three direct contributors to rumination while controlling for the influence of all other variables: diminished effortful control, positive beliefs, and self-consciousness. This study is the first to integrate metacognitive and self-regulatory frameworks of rumination in a data-driven manner. Our findings suggest that there are multiple pathways towards rumination, which should be incorporated in clinical case conceptualization of rumination and related disorders. The results will be discussed in the context of cognitive neuroscience literature.

Location: Cafeteria
Poster 2

Cognitive decline, decompensation and the role of neurodivergence in older adults

Chris Hill, Dorina Cadar, Lisa Quadt

Background:

The aging process is poorly understood in the neurodivergent population, and little is known about possible changes and risks at later stages of life. This lack of understanding may lead to increased adverse outcomes. This study aims to explore differences in cognitive decline and decompensation related to neurodivergent traits in older adults. This study is being undertaken by a medical student as part of an independent research project, and results will be collected and analysed by March 2024.

Methodology:

In this cross-sectional study, adults over the age of 50 with and without cognitive decline will complete screening tools for autism (RAADS-14) and ADHD (ASRS-5). We will test for group differences on Cognitive Difficulties Scale (CDS) scores, and abilities to compensate.

Hypotheses:

Hypothesis 1 – Participants who score above threshold on RAADS-14 and ASRS-5 will show increased levels of cognitive decline, indicated by a higher CDS score, than those who score below threshold.

Hypothesis 2 – Those in the dementia group will have a higher level of neurodivergence, indicated by higher RAADS-14 and ASRS-5 scores, than those without.

Hypothesis 3 – Neurodivergence and higher levels of cognitive decline will be linked with lower scores of compensation, indicating higher decompensation in relation to cognitive decline.

Outlook:

This study will likely contribute to our knowledge about the ageing process and associated risks in neurodivergent adults. Our findings may help us better identify neurodivergence in those experiencing cognitive decline and thus improve support and outcomes.

Location: Cafeteria

Poster 3

Non, je ne regrette rien: Cardiac and brain concomitants of regret in relation to depressive symptoms

Frederik M. van der Veen, Djamilah Mohamed, Daniel Hellemons, Jens Allaert

Risky decisions are often accompanied by unfavorable outcomes, followed by feelings of regret. Previous studies have shown that increased subjectively reported and neurobiological reflections of regret are associated with clinical depression. This study aimed at extending these findings to depressive symptoms in healthy participants and examined the association between depressive symptoms and neurobiological, behavioral, and subjective reflections of regret in a sample of healthy, female, undergraduate psychology students (N=93). Participants performed a sequential risk-taking task, in which they were confronted with optimal, suboptimal, and non-optimal outcomes. Higher depression scores were associated with more subjectively reported regret. Less favorable outcomes were associated with more risk taking in subsequent trials and stronger cardiac deceleration, but both were not associated with higher depression scores. Largest P3 amplitude was found for the infrequent optimal outcomes, but P3 amplitude was not associated with depressive symptoms. This study extends the findings of an association between subjective feelings of regret and depressive symptoms to healthy young female participants but did not find clear associations between both behavioral and neurobiological measures of regret and depressive symptoms.

Location: Cafeteria

Poster 4

A preliminary investigation of reduced GABA concentration by peripheral nerve stimulation in patients with anxiety disorder

Jieun Kim, Changjin Jung, Sunyoung Choi, Hyungjun Kim

Approximately 50% of patients with anxiety disorder do not respond to first-line pharmacological or psychological treatments, leading to a growing demand for alternative therapeutics to pharmacological or psychological therapies. Neurostimulation, including the repetitive transcranial magnetic stimulation has proven efficacy with less adverse effects in anxiety disorder, however the underlying mechanism of action remains to be elucidated.

In this study, we aimed to investigate the neural effects of the peripheral nerve stimulation (median and auricular vagus nerve) in patients with anxiety disorder. Nine participants clinically diagnosed with anxiety disorder underwent 7.0T MRI brain spectroscopy scans, consisting of a 5-minute rest and a 10-minute with nerve stimulation. To access changes in neurotransmitters to nerve stimulation, we adopted a block-design stimulation paradigm (1-minute alternating blocks of stimuli and rest).

At rest, we found a positive correlation between gamma-aminobutyric acid (GABA) concentration in the anterior cingulate cortex and both anxiety and depression (BAI: $r=0.62, p=0.075$, BDI-II: $r=0.71, p=0.034$). This finding represents an association between elevated GABA levels and more severe symptoms in patients.

We conducted a liner regression analysis to access the association between GABA concentration and nerve stimulation. We found a tendency of decreased GABA level to nerve stimulation (t-stats of linear regression: -1.03 ± 1.39 , $p=0.058$ for one-sample t-test). GABA is the major inhibitory neurotransmitter and the elevated GABAergic inhibition is believed to suppress neural activity contributing to symptoms in patient with anxiety disorder. Our results are preliminary with small number of participants, however, demonstrated that nerve stimulation is potential avenue for therapeutic interventions in anxiety disorders.

Location: Cafeteria
Poster 5

Nonverbal Synchronization of Therapist and Patient in the Psychotherapeutic Intake Interview

Adrian Jusepeitis

Theoretical Background: In interpersonal communication, individuals unconsciously synchronize movements, and the degree of synchrony correlates positively with relationship quality. Some studies suggest similar dynamics in psychotherapeutic interactions, indicating a link to positive therapy outcomes. However, these studies often overlook pseudosynchrony, leading to inflated effects. Our objectives are to a) replicate prior therapy synchronization research using automated video-based methods and b) extend this analysis to therapeutic intake interviews.

Research Question: What is the extent of synchronization between therapists and patients, and what is the significance of dyadic synchronization strength?

Methods: We recorded more than 40 therapeutic intake interviews, tracked head and body movements through Motion Energy Analysis, and assessed synchronization using Windowed Cross-Lagged Correlation. We analyzed synchronization strength and frequency, comparing against randomized dyads (pseudosynchrony), and correlated with patient symptoms (Mini-SCL), mood (MDBF), and therapeutic alliance (WAI-SR by patients and therapists).

Results: Controlling for pseudosynchrony, we observed above-chance nonverbal synchrony exclusively in head movements, with a one-second maximum delay. Body movements and longer delays showed no above-chance synchrony. Therapists varied significantly in average nonverbal synchrony. However, dyadic synchrony did not systematically relate to patient symptoms, mood, or therapeutic alliance.

Conclusion: Contrary to expectations, our study in psychotherapeutic initial sessions did not support hypotheses on nonverbal synchrony. Findings underscore the necessity for refining and standardizing Motion Energy Analysis in synchrony studies. The limited time window for demonstrated synchrony and therapists' divergent synchrony levels warrant further theoretical exploration of nonverbal synchrony's role in psychotherapy.

Location: Cafeteria
Poster 6

Investigating pupil responses to faces and motion in autistic children

Camille Ricou, Vivien Rabadan, Yassine Mofid, Joëlle Malvy, Diane Defresne, Hugo Zoppé, Frédérique Bonnet-Brilhault, Claire Warda, Nadia Aguillon-Hernandez

Introduction: Faces are a crucial source of social information, via the spatial arrangement of their features (eyes, nose and mouth) but also their dynamic component (subtle postural adjustments and emotion expression). Face observation induces physiological engagement, indexed by pupil dilation, which is larger for ecological dynamic than static faces. Autism spectrum disorder (ASD) is often associated with poor processing of faces, reflected by a reduced pupil dilation in response to faces compared to their neurotypical (NT) peers. However, the relative influence of social and motion content on pupil dilation in autistic and NT populations is not clear. This study aims to characterise the physiological engagement with stimuli along a gradient of social salience (non-social to social, going from objects to avatars to real faces) and dynamism (static to micro to macro-motion) in NT and autistic children. Method and summary of results: 50 NT and autistic children aged 2 to 12 years old were recorded with a 250Hz eye tracker. We analysed the event-related pupil dilation (mm). Our preliminary results showed that all stimuli induced pupil dilation in both groups with, however, a higher dilation in NT compared to autistic children. Higher dilation was observed in NT in response to social and dynamic stimuli. Main conclusions: Overall, the use of a gradual social salience stimuli paradigm allowed us to characterise the influence of social and motion components on physiological engagement in ASD. Consequently, our results could refine the use of pupil dilation as a biomarker to help in diagnosing ASD.

Location: Cafeteria
Poster 7

Linking Olfactory Impairment and Positive and Negative Symptoms in Schizophrenia: A Meta-analysis

Letizia Zurlo, Elisa Dal Bò, Claudio Gentili, Cinzia Cecchetto

The sense of smell plays a key role in many facets of our daily life, influencing enjoyment of food and threat detection, as well as impacting our mood and social relationships. Numerous studies have provided robust evidence of abnormal olfactory functioning in various mental disorders, including schizophrenia. This multifactorial syndrome is characterized by a spectrum of both positive and negative symptoms. The positive symptoms involve bizarre additions to an individual's typical functioning (e.g., delusions and hallucinations), while the negative symptoms refer to a lack of normal characteristics (e.g., anhedonia and social withdrawal). Crucially, the latter are the most challenging to treat and represent the most prevalent and common first symptoms in schizophrenia. An updated meta-analysis of 74 publications was carried out to explore (a) whether olfactory deficits in schizophrenic individuals are specific for distinct olfactory abilities (i.e., odor identification, discrimination, and threshold), and (b) the modulatory effects of positive and negative symptomatology on distinct olfactory abilities. Results revealed that (a) patients performed significantly worse than healthy controls in the olfactory identification and discrimination, and (b) the negative symptoms have a significant impact on the identification performance, meaning that higher scores of negative symptoms are linked to poorer odor identification ability in schizophrenia patients. Our findings may be explained by the partial overlap between the olfactory pathways and the brain areas implicated in the symptomatology of schizophrenia, thus emphasizing the importance of olfactory assessment in the early diagnosis, monitoring, and prediction of outcomes in schizophrenia.

Location: Cafeteria
Poster 8

A Network Tree Approach to Model Heterogeneity in Rumination: The Curious Case of Effortful Control

Kristof Hoorelbeke, Gerly Tamm, Laura Mertens, Ernst Koster

Experimental studies suggest the causal involvement of cognitive control in rumination (Vander Zwalmen et al., 2023), a form of repetitive negative thinking that places one at risk for depression. However, little is known regarding how different aspects of rumination interact to contribute to depression vulnerability. In this context, recent studies have relied on network analysis to model trait rumination as a system of repetitive negative thoughts (e.g., Bernstein et al., 2019). Building on this, the current study aims to model the interrelations between central ruminative features, assessed using the Ruminative Response Scale (Treynor et al., 2003), taking into account heterogeneity induced by individual differences in effortful control (Adult Temperament Questionnaire) and related variables (e.g., metacognition). For this purpose, we will rely on network tree analysis, applied to a sample of N=1000 participants who are recruited through Prolific Academic and preselected to be representative for the adult UK population. Network tree models result from a combination of network estimation and machine learning techniques (e.g., model-based recursive partitioning), recursively splitting a sample based on covariates in order to detect significant differences (optimal splits) in network structure. These analyses will increase our knowledge regarding how individual differences in effortful control and related variables relate to rumination as a complex system of repetitive negative thoughts.

Location: Cafeteria
Poster 9

Predictive Coding in the Theory of Mind network: A comparison of autistic and non-autistic adults

Lucie Zimmer, Hilary Richardson, Carolina Pletti, Markus Paulus, Tobias Schuwerk

While some neuroscientific research indicates differences between autistic and non-autistic individuals in brain regions that support Theory of Mind (ToM) reasoning (e.g., Kana et al., 2014), robust, reliable neural differences in autism remain elusive. According to the predictive coding (PC) theory, autistic individuals' ToM reasoning difficulties arise from an attenuated use of prior information about others' mental states to explain and predict their behavior. This weakened use of prior assumptions makes the social world less predictable for autistic people, causing interactive mismatch and stress (Bolis et al., 2018; Pellicano & Burr, 2012). To find evidence for PC processes in the ToM network, we attempted to replicate a narrative anticipation effect, measuring mental state predictions, previously reported in children (Richardson & Saxe, 2019), in neurotypical adults (Experiment 1) and tested whether this effect was attenuated in autistic adults (Experiment 2). We presented a short movie showing mental states with associated actions twice to 78 neurotypical adults who underwent fMRI [Experiment 1: $M(SD)age = 26.3(4.3)$ years]. In Experiment 2, we used the same protocol with 30 autistic [$M(SD)age = 32.4(10.7)$ years] and 30 neurotypical adults [$M(SD)age = 33.2(10.1)$ years] matched for gender, age, and intelligence. Preliminary univariate analyses revealed no narrative anticipation effect in the ToM network in either experiment; we also did not observe significant differences between autistic and non-autistic participants in ToM network narrative anticipation. Based on further analyses, we will discuss final results and implications at the conference.

Location: Cafeteria
Poster 10

Facilitating Interoceptive Nuances and Enhancement (FINE) in clinical settings.

Adrian Yoris, Lorena Canziani, Tomás Llambí

The brain, operating as a predictive machine, refines internal models of the world. In severe psychiatric conditions such as schizophrenia (SZ), negative symptoms i.e., dulling, abulia, and social withdrawal, can be associated with interoceptive impairment. Improving interoceptive precision and awareness through learning can reduce SZ negative and affective symptoms such as anxiety. Interoceptive learning, often focusing on gross counting or discriminating internal vs external cues requires fine-tuning for improved awareness. FINE: Facilitating Interoceptive Nuances and Enhancement is a developing cardiac interoceptive training technology, for enhancing precision and awareness in clinical settings. This tool, integrated with a mobile environment, allows real-time monitoring and personalised training based on ECG activity. FINE's fine-tuning capabilities allow users to align the perception of their cardiac signals and develop up to the finest precision and awareness. Preliminary data and scopes of this technology in mental health will be discussed.

Location: Cafeteria
Poster 11

When Dystopia Becomes Real: Judging Others for Their Moral Convictions

Hande Özlem Atar

We have a tendency to judge those who disagree with our own moral convictions, just for thinking so. Moral conviction refers to a firm belief that something is moral or immoral, grounding attitudes towards others. Studies showed that when making moral judgements, individuals predominantly rely on information about the act itself and how much harm has been caused, as well as the agent's intent to cause such harm. Here, we ask if agents' moral convictions also play a role in this process. We presented participants with scenarios in which an agent who held a conviction that the participants either shared or not (e.g. domestic violence is acceptable) and engaged in some action, which either caused harm to others or not (e.g. not assaulting partner). Participants then judged the agent in terms of moral character, wrongness of the behavior, blameworthiness, and the punishment deserved. In doing, so we pitted Conviction (congruent/incongruent) against Action Outcome (harmful/harmless) thus disentangling their respective roles in moral decision making. We found that participants indeed judged, blamed, and punished the agent with an incongruent conviction more harshly, even when the action was harmless. When harm was done, convictions mitigated the harshness of character judgment towards the agent. Moreover, character judgment relied on the agent's conviction; while wrongness, blame, and punishment judgments heavily depended on the action outcome. Together, these results reveal a particular judicial bias in our moral judgments, a weak spot for those who share the same beliefs with us.

Location: Cafeteria
Poster 12

Mafias in the mind: a multi-method approach to the study and the promotion of anti-mafia attitudes and behaviors

Valerio Placidi, Matteo P. Lisi, Salvatore M. Aglioti

Mafia-type criminal organizations pursue lucre and power through illegal practices posing a global threat in terms of deaths and economic impact (Cartwright & Bones, 2017). Knowledge concerning the psychological dimensions that predict attitudes and behaviors toward mafias (e.g., Travaglino et al., 2014) is limited, and no validated practices exist to promote anti-mafia action. The present project aims to fill this gap using multiple investigation techniques.

First, an online survey was conducted to explore predictors of the intention to act against mafias, assessed through a novel mouse-tracking task. The same survey was employed to select a character known for their anti-mafia involvement, essential for an ongoing experiment, which aims to evaluate whether the embodiment of a known anti-mafia character, in virtual reality (VR), enhances participants' anti-mafia attitudes and collective action intentions.

Survey results revealed that the decision to undertake anti-mafia actions and the conflict in the response process are predicted by attitudes toward mafias, perceived risk of the action and geographical region of residence. Moreover, we found that Giovanni Falcone was among the most recognized characters and rated the highest on heroic dimensions. Those results provide the first quantification of anti-mafia characters recognition and evaluation paving the way to the VR studies, that we will present during the conference.

An innovative multi-method approach to the study and promotion of anti-mafia attitudes and behaviors is presented. Preliminary findings shed light on individual differences involved in the decision conflict to participate in anti-mafia activity.

Location: Cafeteria
Poster 13

How embodying the supreme moral judge shapes moral decision making

Althea Frisanco, Gaetano Tieri, Aurora Bacchetta, Salvatore Aglioti

Recent investigations have brought to light the potential of virtual embodiment illusions in influencing individuals' perceptions, attitudes, and behaviors —a phenomenon referred to as the Proteus effect. Expanding upon this line of research, we delved into the consequences of embodying an anthropomorphic representation of the Christian God (i.e., the supreme moral-judge) on moral decision making. We observed 100 participants solving an immersive version of the Trolley and Footbridge dilemma while they were embodying the God-avatar or a control-human one. We measured participants' resolution (deontological or utilitarian), reaction time, post-decision feelings, and physiological responses. Preliminary analyses revealed that the God-avatar influenced heart rate when participants chose the utilitarian resolution in the Trolley dilemma, and led to perceive as more morally acceptable the utilitarian resolution in the Footbridge dilemma. Furthermore, participants' subjective representation of God affected their post-decision feelings in the Footbridge dilemma, where the stronger their perception of God as benevolent, the more profound their feelings of guilt and shame, and the lower the evaluation of the utilitarian resolution as morally acceptable. In conclusion, physiological responses and moral evaluations suggested that embodying an avatar deemed to be a moral judge might influence one's experience of moral conflict, leading people to perceive themselves more responsible for the decision and more entitled to intervene in human life. These findings extend the Proteus effect to the moral domain and offer insights into using avatars resembling role-models, who are assigned with personality traits and social roles that have key roles in determining outcomes.

Location: Cafeteria
Poster 14

How Action Goals Shape Imitative Response Tendencies

Maximilian Marschner

Understanding people's tendency to imitate others' actions is central to research on social interaction. Yet, an unresolved question is how imitative response tendencies become shaped by higher-level goals guiding observed and executed actions. We approached this question by investigating whether effects of congruency between observed and executed actions become modulated when both actions contribute to an overarching joint action goal. In three online experiments, participants selected one of two action targets that differed on a relative magnitude dimension in turns with a virtual partner. We manipulated imitative congruency between co-actors' actions at the level of their individual goals (selecting the target with the higher/lower value) and on the level of their spatial response features (selecting the right/left target). The first two experiments revealed large performance costs when participants were explicitly instructed to adopt incongruent goals compared to their partner, which was further found to reverse imitative congruency effects related to spatial features of co-actors' executed responses. Crucially, reframing the task by instructing participants to produce joint outcomes together with their partner did not influence the result pattern. The third experiment showed that others' action goals have persistent effects on subsequent action performance even when they are not explicitly task-relevant and when congruency relations between one's own and others' action goals are cued in advance. Our results support goal-directed theories of imitation and show that contagious effects of others' action goals persist in joint action contexts.

Location: Cafeteria
Poster 15

Neural Synchrony during Negative Affect: Insights into Dyadic Social Interactions

Vanessa Nöring

In hyperscanning research, interbrain synchrony (IBS) within the mentalizing and mirror neuron networks has repeatedly been observed when individuals engage in cooperative and competitive scenarios. However, the predominant focus on cooperation and competition underscores a critical gap in our understanding of more naturalistic social interactions. Given the central role that emotions play in such interactions and for social bonding more generally, investigating IBS in the context of emotional experiences could provide new insights into the neural underpinnings of social interaction. In the present study, a sample of 14 dyads undertook a social interaction paradigm during which they discussed emotionally negative events from their lives as well as neutral topics. Each event trial lasted for 120 seconds and was concluded with a brief rating of the conversation on valence, arousal, connection and dominance. Brain activity was measured using functional near-infrared spectroscopy (fNIRS). Regions of interest include the right (dorsolateral) prefrontal cortex and temporoparietal junction. Preliminary analysis of the rating data indicates a successful manipulation of affective experiences during the experiment. To evaluate the extent of IBS between interacting individuals, wavelet coherence will be calculated and compared across emotional and neutral conditions. Additionally, a permutation analysis will be conducted to discern whether synchrony within real dyads differs significantly from baseline synchrony. This study aims to offer initial insights into the relationship between emotions and interpersonal neural synchrony, potentially establishing a foundation for future research on interpersonal difficulties within clinical populations.

Location: Cafeteria
Poster 16

Social perspective-taking influences on metacognition

Lucas Battich, Elisabeth Pacherie, Julie Grèzes

We often effortlessly take the perceptual perspective of others: we represent some aspect of the environment that others currently perceive. However, taking someone's perspective can interfere with one's perceptual processing: another person's gaze can spontaneously affect our ability to detect stimuli in a scene. But it is still unclear whether our cognitive evaluation of those judgements is also affected. In this study, we investigated whether social perspective-taking can influence participants' metacognitive judgements about their perceptual responses. Participants performed a contrast detection task with a task-irrelevant avatar oriented either congruently or incongruently to the stimulus location. By "blindfolding" the avatar, we tested the influence of social perspective-taking versus non-social directional orienting. Participants had higher accuracy and perceptual sensitivity with a congruent avatar regardless of the blindfold, suggesting a low-level directional cueing effect. However, their metacognitive judgements were more efficient only when participants believed that the congruent avatar could also see the stimulus. These results suggest that perceptual metacognitive efficiency can be socially enhanced by tracking someone's perspective and sharing perception of the same objects with them.

Location: Cafeteria
Poster 17

Utilitarian Value Difference and Victim Approval in Moral Decisions are both Processed in Posterior Cingulate Cortex and Angular Gyrus

Yu Liu, Motoaki Sugiura

Decisions in Trolley-problem-like dilemmas are dependent on emotional and utilitarian values of the options. In our earlier study, we found that (1) utilitarian value difference and (2) emotional values of the victim (i.e. the abandoned option) are the two factors that determines perceived difficulty of decisions. Preceding research showed that emotional and utilitarian values of the options are independently processed in the brain. However, it remains unknown about the neural substrates of factor (1) and (2) and if they are independent or not. In this study, we collected functional MRI data of 40 participants. Participants were asked to save 1 fictional character and to leave the other one as victim in each trial. Those characters are described with realistic photos and stories that are deliberately designed to make them receive low or high emotional and utilitarian evaluations. With regression analysis, we tested correlation of brain activation with (1) emotional and utilitarian value differences between options, and with (2) emotional and utilitarian values of the chosen and unchosen option. These values are calculated based on evaluations given by each participant individually. Consistent with our previous results, utilitarian value difference in analysis (1) showed negative correlation and emotional value of the unchosen (victim) in analysis (2) showed positive correlation. Interestingly, active brain areas that correlate to these two factors are mostly overlapping in posterior cingulate cortex and angular gyrus. Overlapping of the correlated brain areas indicates that emotional value of victim and utilitarian value difference affect perceived difficulty perception through common processes.

Location: Cafeteria
Poster 18

Naltrexone affects both firsthand and empathic pain – a pharmacological within-subjects study

Julia T. Braunstein, Markus Rütgen, Claus Lamm

Empathy is a fundamental social-cognitive ability, allowing one to infer about the affective state of another individual and resonate with it, which is crucial for interpersonal relationships. On a neural level, this ability to empathize with others might stem from so-called ‘shared representations’, patterns of neural activation recruited both during the firsthand, as well as the empathic experience of a specific affective state. Correlational evidence for this account using fMRI repeatedly showed overlaps in brain activity for firsthand and witnessed pain. However, despite this correlational support, there's a shortage of studies offering causal evidence. Some research inducing placebo analgesia has shown consistent reduction in behavioral ratings and neural activity for both firsthand and empathic pain experiences. Although their findings support the ‘shared representations’ theory, their use of placebo analgesia makes it difficult to infer about the origin of their effects – whether they are due to pharmacological mechanisms or other top-down cognitive processes. To bridge this gap, we conducted a double-blind, within-subjects study administering both an opioid antagonist (naltrexone) or an inactive placebo before an empathy for pain paradigm on two subsequent testing sessions. We collected data of 35 participants (21 female individuals) and found that naltrexone reduced both firsthand pain and empathy for pain. While contrary to our hypothesized direction, the directional coherence of this substance effect suggests a shared opioidergic mechanism between the firsthand experience of pain and empathy for pain.

Location: Cafeteria
Poster 19

The effect of "mere presence" when observing gestures: a physiological study

Angela Bartolo, Lila De Pellegrin, Fabrizia Gallo, Alberto González-Villar, Adriana Sampaio, Jean-Louis Nandrino

The physiological responses of an individual observing gestures vary depending on whether they are directed towards the body (TB) or away from the body (AB). However, observing gestures in social settings is common in everyday life, and in the presence of social cues, individuals may adjust their behaviour compared to when they are alone. In the present study, we aimed to investigate whether the presence of an unfamiliar individual of the same or different gender modulates participants' physiological responses during the observation of TB and AB gestures. In a first phase, sixty participants observed gestures alone, while in a second phase they repeated the task in the presence of a confederate of the same (n=14 Females with a Female confederate - FF; 14 Males with a Male - MM) or different gender (14 Females with a Male - FM; 14 Males with a Female - MF). The results showed that the presence of a male confederate modulated pupil dilation differently in males and females, especially for TB gestures conveying a mental state (e.g. I'm freezing). Compared to the single conditions, FM showed a reduction in pupil dilation, whereas MM showed a significant increase in this parameter. Furthermore, when the participant and confederate were of different genders, we observed a modification of vagal suppression compared to the single condition. We found decreased vagal suppression in FM and increased vagal suppression in MF. These results suggest that the social context in which we observe gestures modulates the physiological parameters of individuals.

*Location: Cafeteria
Poster 20*

Propensity to Revenge: a fNIRS Study on Forgiveness and Dark Factors of Personality

Milana Makarova, Alexey Upravitelev, Maxim Petrov, Nare Meloian, Ekaterina Shugarova, Andrey Kurpatov, Nataliia Volkova

Revenge is an act of social behavior that is influenced by a complex set of factors. We are focusing our research on dark factors of personality (D) that refers to the general tendency to maximize one's individual utility — disregarding, accepting, or malevolently provoking disutility for others — accompanied by beliefs that serve as justifications. These factors may exert negative effects on forgiveness. To investigate the neurobiological basis of this proposition, 80 subjects with high vs. low D scores complete an ultimatum game (UG) and a dictator game (DG) with 40 trials for each game for every participant. Data collection is organized in the following way. In the UG, the participants accept or reject offers from the fair or unfair virtual opponents. After that, in the DG setting, they have the opportunity to forgive or take revenge on the unfair opponents by allocating fair or unfair amounts of money. During this task, the activity of the dorsolateral prefrontal cortex (DLPFC) is assessed via functional near-infrared spectroscopy (fNIRS). We hypothesize that the participants with high D scores exhibit significantly more revenge-seeking behavior than the individuals with low D scores, and this behavioral difference is reflected in the activation pattern of the left DLPFC, since its activity is associated with retaliation. Data collecting is ongoing, results will be presented during the conference.

Location: Cafeteria
Poster 21

The Impact of Dark Factor on Cooperation in Married and Stranger Dyads: a fNIRS-based hyperscanning study

Milana Makarova, Nare Meloian, Irina Evdokimova, Alexey Upravitlelev, Andrey Kurpatov, Nataliia Volkova

The topic of interpersonal brain synchronization (IBS) in dyads has received significant attention from researchers in recent years. Utilizing functional near-infrared spectroscopy (fNIRS), we are planning to conduct a hyperscanning research to investigate the neurological effects of cooperation. 120 subjects will be divided into two distinct dyadic groups which are going to be examined in this study: married couples (30 dyads) and paired up total strangers (30 dyads). Both dyads are offered to be involved in two separate types of cooperation tasks. The initial trial assesses each participant's reaction time: members of dyads sit side-by-side, separated by a board and in front of a shared computer display, and press a button when they see green signal. In the second trial, an experimental design known as "Battles of Sexes" is employed, featuring a coordination game in which the participants must reach a consensus on how to allocate their evening. By the trial, each participant will run the Interpersonal Reactivity Index (IRI; Davis, 1980) to assess empathy across four main dimensions and the dark factors of personality (D) test, which refers to the general tendency to maximize one's individual utility, accompanied by beliefs that serve as justifications. We seek to confirm the result of higher cooperation and IBS in married couples compared to strangers (Pan et al., 2017). Furthermore, we hypothesize that dyads characterized by diminished empathy and elevated dark factor traits will manifest markedly reduced cooperation levels in contrast to those with converse attributes.

Location: Cafeteria
Poster 22

Unraveling Partisan Misinformation: EEG insights into Political Bias and Cognitive Flexibility

Daniela Lizarazo Villarreal

In today's digital era, misinformation shapes political landscapes and public discourse. Thus, understanding its cognitive underpinnings is crucial. As online platforms rapidly spread information with varying degrees of accuracy, discerning truth from misinformation becomes vital. This highlights the need to understand the cognitive processes guiding our perception and interaction with digital content. Literature on political extremism suggests that those who are on the far right of the spectrum are less sensitive to discerning false claims, and more likely to share misinformation in comparison to moderates and liberals. However, the reasons behind this difference are still unknown.

In this study, we will examine whether cognitive flexibility explains differences in misinformation sharing across the political spectrum. We will recruit a sample of conservatives and liberals in Spain (N = 100) who will participate in an EEG study. Participants will complete a Stroop task, a classical cognitive conflict task assessing cognitive flexibility, and we will extract the difference in amplitude of fronto-medial Theta oscillations between conflict and congruent trials. Moreover, we will obtain participants' likelihood of sharing partisan misinformation and will capture behavioral changes in response to fact-checking interventions aimed at reducing misinformation sharing. We will then compare the EEG correlates of cognitive conflict across conservatives and liberals, and examine whether participants' likelihood of sharing partisan misinformation and susceptibility to fact-checks can be predicted by EEG correlates of cognitive flexibility. This approach could illuminate the cognitive mechanisms at play in our interactions with complex political information, offering insights into effective misinformation mitigation strategies.

Location: Cafeteria
Poster 23

Understanding the mechanisms underlying racial and gender biases in impression formation using drift-diffusion modeling.

Lucile Bottein, Lou Safra, Julie Grèzes

Gender and ethnic inequalities remain a pervasive issue despite many systemic advancements. This can be partly explained by the persistence of implicit biases, triggered outside of conscious control and independently from explicit belief-systems. These biases exist even within highly educated individuals who do not endorse discriminatory beliefs, as is reflected by continued hiring inequalities in academic settings. We ran two series of experiments exploring both racial and gender implicit biases in a highly educated antiracist French population. In the first series -where participants emitted rapid binary trait judgments (competent or incompetent) on target avatar faces varying in ethnicity (black or white) and competence level- we found a pro-black bias. This echoes previous findings; participants who are intrinsically motivated to not be racist tend to show a pro-black behavioral bias. However, in the second series, we used the same task with photographed faces varying in both ethnicity and gender and found a pro-black bias in male targets and a pro-female bias in white targets, but an intersectional pattern of bias disfavoring competence judgments for black women. These results were partly explained by participants' cognitive control skills and motivations to suppress the expression of prejudice. To gain insight on the possible mechanisms generating this pattern of results, judgments and response times from each study will be submitted to a pre-registered drift-diffusion model (DDM) analysis. The results produced will have implications beyond theory; understanding when and how implicit bias impacts the decision-making process can help better orient interventions aiming to reduce discriminatory outcomes.

Location: Cafeteria
Poster 24

Feeling and acting together: effects of emotion on strategic cooperation and motor coordination during joint action

Victor Chung, Julie Grèzes, Elisabeth Pacherie

Previous work argued that experiencing emotions together (collective emotion) facilitates acting together (joint action). Research on social movements indeed highlights that emotion motivates group members to take collective action. In contrast, there is little evidence of the effects of emotion on the coordination processes involved in joint action. The present study aims at addressing the following question: how does collective emotion, which involves experiencing similar emotions with other individuals, influence joint action, which involves motor coordination and strategic cooperation?

In this experiment, we adapt a collaborative computer-based task (Bars, S. L. et al. 2022. Motor Coordination and Strategic Cooperation in Joint Action, *Psychol Sci*, 33(5), 736-751). Same-gender dyads ($n = 50$) of physically co-located participants are instructed to jointly move a cursor towards one of four different targets representing combinations of individual pay-offs. For each trial, we manipulate the pay-off combinations and the participants' role, and we induce positive and negative emotions by increasing (positive) or decreasing (negative) final payoffs for both participants similarly. We measure emotional responses (self-reported valence and arousal, facial electromyography and skin conductance), prosocial attitudes (social identification) and the levels of cooperation (prosocial decisions) and coordination (completion time) within the dyad.

We hypothesize that average emotional arousal within the dyad predicts social identification and cooperation, whereas the similarity and synchrony of emotional responses (subjective, physiological) between participants predict their coordination. We expect the present study to shed light on the role of shared emotions (positive and negative) in joint action. Data analysis in preparation.

Location: Cafeteria
Poster 25

Mutual prediction under virtual communication

Ziyun Zhang, Carolyn McGettigan, Antonia Hamilton

To facilitate fluent communication, it's crucial for individuals to predict each other's actions and carry out their own actions effectively, a process linked to interpersonal neural synchrony (Hamilton, 2021; Kingsbury et al., 2019). However, breakdowns of such interpersonal communication are prevalent in today's online meetings due to poor internet connections. The impact of such breakdowns on interpersonal neural synchrony remains limited. To address these questions, we developed an fNIRS hyperscanning study simulating an online meeting situation. We introduce connection breakdowns (via added noise) to gauge their impact on interaction. Participants, each in front of a computer, can view the other's face and a Spot the Differences game display. Wearing headphones, they hear each other's voices. During joint gameplay, one participant is designated as the Speaker describing a picture, while the other, the Listener, uses the Speaker's description to identify differences between the Speaker's picture and the version they can see on their own screen. The Listener intermittently experiences noise obscuring the Speaker's voice, some noticed by the Speaker by a visual cue and some not. This setup creates three conditions: mutual prediction, partial (one-way) prediction, and unsuccessful prediction between participants. We'll collect fNIRS data and analyze inter-brain coherence across these conditions. We expect that inter-brain coherence will be spotted under mutual prediction condition, but not the other two conditions. The experiment has been physically set up, and data collection is scheduled to start in January.

Location: Cafeteria
Poster 26

Women's sociality is linked to negative facial expression via medial prefrontal cortex and amygdala circuit

Sunyoung Choi

Facial expression is important in social communication. However, the facial expression association with sociality and underlying neural substrates are not fully elucidated. In addition, many previous studies were focused on relation between social skills and recognition of facial expression but not production of spontaneous facial expression to react emotional stimuli, even though few studies have analyzed the differences between spontaneous and intentional facial expression according to social skills. In this study, we measured the spontaneous facial expression under emotional stimuli, and investigated the association with social skill of the empathy questionnaire. Moreover, we used functional Magnetic Resonance Imaging (fMRI) with Facial Expression Task (E-task) to explore neural correlation with social skill and the spontaneous facial expression. In particular, only neurologically healthy women (N=30) were included in this study in order to decrease variance due to sex difference.

Our results showed only negative facial expression under emotional video clip, not positive expression, is associated with social skill, but women's self-rated affect under emotional stimuli was not associated with social skill. We also demonstrate that that left and right amygdala and right middle frontal gyrus(MFG) activation under sad stimuli was associated with the level of negative facial expression, whereas self-rated negative affect was significantly correlated with beta values in periaqueductal gray (PAG) and right inferior frontal gyrus (IFG) under sad stimuli. This result indicates that production of spontaneous facial expression and feeling their emotion, especially for negative emotion, are related to different neural network.

Location: Cafeteria
Poster 27

Impact of Eye Visibility on Identifying and Interpreting Facial Expressions: A Behavioural and Eyetracking Study.

Daniel Granja, Nicolas Burra

The ability to interpret emotional facial expressions is a central emotional skill in social cognition. In Western cultures, eyes are crucial for interpreting these expressions. This study examines whether interpretations change when eyes are not visible, such as when they are closed or obscured by dark glasses. Thus, do we interpret facial expressions similarly, independently of the eyes' perception? Or is our appraisal dependent on how sure the other can see or not? A preliminary observation suggests that certain emotions, like fear, may be completely misinterpreted as others, such as orgasm, when eyes are closed while other are not, like happiness. In the present study, the participants will be exposed to images of faces with emotional (anger, fear, happiness) and neutral expressions with open, closed, or obscured eyes (by dark glasses), and will need to report on discrete emotion scales the facial expressions they perceive. Additionally, the participants' gaze direction will be measured using eye-tracking, to assess the potential reduction of eyes used as cues, as well as their pupil dilation, monitoring their expected physiological activation in response to the viewed emotional expressions. Our study aims to enhance our understanding of the role of eye presence in recognizing emotional facial expressions and how the knowledge of whether someone's eyes are open or closed affects this recognition process.

Location: Cafeteria
Poster 28

Spontaneous perspective-taking: age- and cultural-related differences.

Anne-Lise Florkin, Serena Maria Stagnitto, Gabriele Chierchia, Floris Van Vugt, Serena Lecce, Elena Cavallini

Perspective-taking can be influenced by our culture or our age. Indeed, some studies suggest that collectivistic cultures tend to adopt an egocentric perspective (representational theory), while others propose an easier shift to an alter-centric perspective (attentional theory). Moreover, a greater egocentric interference, along with a higher difficulty to switch to an alter-centric perspective, was observed in older adults. However, no studies have investigated age-related differences, cultural differences, and their interaction effects using a spontaneous perspective-taking task. The main aim of this study was to examine the spontaneous perspective tendencies of younger and older adults of collectivistic and individualistic cultures. In addition, we verified if these spontaneous tendencies were linked to participants' self-reported predisposition to take someone else's perspective. A sample of 83 younger (19-40 years) and 67 older (64-98 years) adults of an individualistic culture, as well as 25 younger (19-34 years) and 26 older (62-75 years) adults of a collectivistic culture completed an online spontaneous perspective-taking task. The study found no significant differences in the spontaneous perspective-taking tendencies between older and younger adults. Nevertheless, older adults required more time to adopt the other's perspective, indicating challenges in inhibiting interference from their own viewpoint. Regarding the culture, more collectivistic adults adopted a self-perspective than individualistic adults, supporting the representational hypothesis. However, no culture and age interaction effects were found. Moreover, results reveal a lack of association between tendency and predisposition to take others' perspectives. Overall, our findings highlight the relevance to investigate spontaneous perspective-taking in aging and in different cultures.

Location: Cafeteria
Poster 29

Comparison of Affordance and Spatial Compatibility Effects in Human and Object Interactions

Pınar Demir, Melda Sandıkçı, Eda Demir, Efe Soyman

Everyday social interactions, such as shaking hands, or goal-directed interactions with objects, such as holding a cup, require facilitation of action plans appropriate to their specific affordances. The spatial compatibility of a stimulus and a response might interfere with the activation of these affordance-compatible action plans. In the present study, we examined how framing of interactions affects the interaction between affordance and spatial compatibility effects towards humans and objects in two separate experiments.

In a motor priming task designed to simultaneously assess affordance and spatial compatibility effects, participants were presented with human interactive hand gestures and everyday objects with a single handle. Participants responded either with their left or right hand according to the color mask of the stimulus, regardless of the spatial position or the affordance-related orientation of the stimulus. In Experiment 1, the responses were given by keypresses and in Experiment 2, participants responded with key releases followed by performing a “holding” gesture.

When responding with simple keypresses, we found independent and strong affordance and spatial compatibility effects towards objects. Surprisingly, interactive hand gesture stimuli induced a reversed affordance effect, that is, mirror-compatible responses, while the effect of spatial compatibility was preserved. Changing the framing from a simple keypress task to an interactive one drastically altered these findings, resulting in enhancement of affordance and complete elimination of spatial compatibility effects for both human and object interactions.

These findings indicate that affordance-related responses for social signals are strongly facilitated by contextual framing of interactions, rather than fixed action representations.

Location: Cafeteria
Poster 30

The influence of romantic partner support on the subjective and neurophysiological substrates of pain

Satja Mulej Bratec

Being supported by significant others is crucial for our mental and physical well-being. Social support can reduce negative emotions, relieve pain and positively affect the individual's physiological systems. Despite the known positive effects of social support, the neurophysiological mechanisms supporting the social regulation of pain have not yet been fully explored. Using an experimental research design, we investigated the influence of romantic partner's supportive presence on the reported perception and related neurophysiological correlates of acute painful stimuli. The experiment involved romantic couples and alternated between two conditions: the supportive presence and absence of the male romantic partner. Throughout the experiment, the woman was exposed to painful stimuli of varying magnitudes while we measured both subjective feelings of valence and pain, as well as brain signals using electroencephalography (EEG). We hypothesised that the presence of the romantic partner would have a positive influence on emotions, pain perception, and event-related EEG potentials. Results firstly showed that supportive presence increased positive feelings and reduced reported pain intensity and unpleasantness. Our findings additionally demonstrated a significant effect of supportive presence on pain-evoked potentials N1, P2 and P3, centred on parietal and frontal electrodes, pointing to notable similarities between social support and placebo analgesia. We further tested and confirmed the influence of both emotional valence and attachment style on the impact of social support on pain. The study offers new insights on the neural underpinnings of social support by a romantic partner, with significant practical and clinical implications.

Location: Cafeteria
Poster 31

Exploring the influence of Choice and Control on Moral Behavior in Virtual Reality: Implications for Free Will Beliefs

Nel Tavernier

For the last 15 years, researchers in psychology have investigated laypeople's free will beliefs (FWB). In particular, studies using experimental manipulations have suggested that inducing disbelief in free will (FW) impacts social behavior and cognitive factors. More recently, however, many of these findings failed to replicate, casting doubt on the downstream effects of FWBs.

The current study aims to use a different approach to investigate whether crucial aspects of our experience of FW, namely our ability to do otherwise or to choose between different options impact our sense of moral responsibility. While this approach moves away from the ambition to change FWB, it might open a more tractable way to investigate how relevant aspects of our experience of FW impact moral behavior. Specifically, participants engaged in a virtual car driving scenario where the level of control over the steering wheel was altered to create two distinct conditions (high control vs low control condition). Only those in the high control condition could control the direction of the car. Following an initial manipulation period, different accident scenarios were presented to participants to assess the influence of the newly created manipulation on moral behavior.

Our results reveal that the manipulation (i.e. low control condition) reduced victim blaming in accident scenarios, increased explicit moral responsibility, and influenced steering behavior. This study contributes valuable insights into the complex relationship between choice, agency, and moral behavior, opening new avenues for investigating the nuanced ways in which the perception of FW shapes human behavior in moral contexts.

Location: Cafeteria
Poster 32

Collective effervescence mediates the effect of individual emotion on spectators' enjoyment of theatrical performances

Ondine Simonot-Bérenger, Victor Chung, Julie Grèzes

Collective effervescence – the subjective feeling of sharing emotions and meaning among participants of a social event – has been described as a central phenomenon to foster social bonding. To date, theatre has been absent from this research field, despite being considered a paradigmatic example of shared emotional experience through its multisecular and transcultural existence. As such, little is known about collective effervescence in theatre and whether it contributes to the audience's enjoyment of the theatrical performance. To fill this gap, we measured the subjective emotions, feelings of collective effervescence and performance enjoyment of 660 spectators in real-life settings, as part of large audiences ranging from 100 to 900 spectators. Data were collected on two different plays : one was performed fourteen times across two French national theatres (416 participants), while the other was performed twenty times in a local theatre (244 participants). Linear regression models indicated that the subjective feeling of collective effervescence varied with spectators' empathetic traits and significantly predicted their enjoyment of the play. Furthermore, mediation analyses revealed that collective effervescence partially mediated the effect of individual emotions on enjoyment. These results provide the first evidence of collective effervescence in theatre, and support our hypothesis that the collective dimension of theatrical events contributes to the audience's enjoyment, even when accounting for individual emotions and traits. This study offers promising grounds to shed light on the complex social nature of theatrical experiences, and subsequently deepen our understanding of collective emotional dynamics among large groups in ecological settings.

Location: Cafeteria
Poster 33

Dynamic Gaze Contact and Attention Deployment: An ERP study

Nicolas Burra, Daniel Granja, Domile Tautvydaite

ABSTRACT:

This research delves into attentional deployment towards gaze shifts, emphasizing the manipulation of dynamic over static stimuli. Event-related potentials (ERPs) were measured in three experiments to analyze and compare the N2pc component, a marker of attentional selection.

In the first experiment, participants had to indicate if faces were gazing towards or away from them, a task involving social attention. Results revealed an acceleration in attentional deployment for dynamic gaze, evidenced faster N2pc responses. This finding highlights a more pronounced attentional sensitivity to gaze contact over gaze shifts, underscoring motion's importance in attentional capture.

The second experiment investigated the role of gaze direction in attentional bias. We discovered that rapid attentional shift towards gaze contact was abolished when primary attentional focus was focused on an irrelevant task. This insight extends our understanding of attentional selectivity to gaze contact and its dependencies on stimulus context.

The third experiment examined how task instructions modulate attentional responses to gaze shifts. The task was non-social, as participants had to only assess the direction of eye movements in facial stimuli. As opposed to social attention task in experiment 1, here we found a diminished attentional enhancement to dynamic gaze shifts. This suggests that attentional system adapts accordingly to cognitive and social demands.

Overall, our study demonstrates that gaze contact quickens attentional deployment, in dynamic and social but not in static and non-social contexts. Our findings illuminate the complex interplay between attentional mechanisms, stimulus motion, and task requirements, enriching our understanding of social attentional processing.

Location: Cafeteria
Poster 34

The contagious leader: behavioural and physiological measures of emotional contagion in organizational settings

Sarah Boukarras, Damla Duman, Althea Frisanco, Donato Ferri, Francesco Bianchi, Laura Borgogni, Salvatore Maria Aglioti

The transmission of moods and emotions in organizations influences many work-related outcomes. Studies indicate that leaders' affective states can propagate to their followers, with important consequences on well-being and performance. Leadership style may further modulate this phenomenon, with transformational leaders (i.e., those who "inspire" their collaborators to continuously improve for their own well-being and for the good of the organization) more likely to use emotions as communicative tools. However, the biological correlates of emotional contagion in organizations are underexplored.

To address this issue, here we examined emotional contagion dynamics in organizations combining behavioural and psychophysiological methods. In Experiment 1, 28 managers ("leaders") and 92 employees ("followers") from a financial consulting company were asked to give a brief speech imagining convincing someone to join the company, while being recorded with a video camera. During the speech, participants' heart rate, electrodermal activity and face temperature were also recorded. The presence of emotional facial expressions displayed during the speech is investigated through an AI-based software. In Experiment 2, the same participants are presented with the speech videos recorded in Experiment 1. Leader-to-follower and follower-to-leader contagion is quantified as the time-lagged synchronization between the speakers' and the observers' time series of physiological and facial expressions data. Preliminary results from Experiment 1 indicate that, although leaders displayed less happy and more neutral expressions during the speech compared to followers, transformational leadership scores correlated with the frequency and intensity of happy expressions. Thus, transformational leaders indeed appear more inclined towards the nonverbal display of positive emotions.

Location: Cafeteria

Poster 35

State-dependent variation of human body odors: from molecular changes to perception

Antonie Bierling, Robert Hanus, Natan Horacek, Pavlina Kyjakova, Ilona Croy

Body odors play an important role in social communication. For example, they influence sexual attraction, create a sense of belonging in the family, or allow us to infer emotions such as fear or happiness in other people. Still, most research on nonverbal communication is based on face perception, gesture, or voice. With this study we aim at characterizing the state-dependent variation of healthy human body odors and their perception.

To this end, axillary sweat was sampled from 40 young male donors in four different conditions (exercise, stress, sexual arousal, control) and the pooled samples were rated on six visual analogue scales and a newly developed multiple choice description matrix of qualitative descriptors by 74 normosmic perceivers. Furthermore, the samples were analyzed for their chemical components using gas chromatography analysis, and electronic fingerprints were estimated using an electronic nose.

First results show that receivers can differentiate between some of the body odor conditions and that this aligns with differences in the pattern of emitted volatile organic compounds. Further results will be presented.

Location: Cafeteria
Poster 36

Human perception of social contingency in genuine and fake audiovisual dyadic interactions

Rudradeep Guha

While social interactive behaviour has been studied in terms of interpersonal alignment of nods or eyeblinks, there is a dearth of research into how such cues contribute to the detection of social contingency, i.e.- how do we know whether two people are actually interacting with one another?

We developed a novel experimental paradigm in which observers (N=18) were asked to discriminate between genuine and fake video recordings of male-female conversations, extracted from an existing speed-dating dataset (Arias, 2021). The ‘fake’ recordings were montages of people who appeared to be talking to each other, but were in fact originally recorded while talking to other people (i.e.- with no, or only incidental, contingency). In each recording, only one of the two persons was talking, thereby forcing judgements of genuineness to rely on the co-dependency of the speaker’s expression and the listener’s backchanneling (e.g.- nodding at the end of a sentence)

Observers were above chance at discriminating genuine from fake interactions (accuracy $M=0.6$, $t(17)=10.9$, $p<0.05$). We fitted participant ratings of the genuineness of interactions with a model that predicts the listener’s facial action units from the RMS envelope of the speaker’s speech, and showed that while genuine interactions were characterized by significant mouth-area backchanneling (e.g.- AU12/smile), observers tended to rely on blinks (AU43) instead – to the extent of making “social false alarms”. To extend beyond mere correlation, we will present additional experimental data testing whether manipulating these cues (e.g.- masking certain facial features) in prerecorded interactions mechanistically influences observer judgements of genuineness.

Location: Cafeteria
Poster 37

Motor inhibition in joint action with natural and artificial agents

Giulia Siri, Abdulaziz Abubshait, Davide De Tommaso, Alessandro D'Ausilio, Agnieszka Wykowska

Motor inhibition is crucial for effective collaboration between people, as it allows us to suppress and adjust actions in joint action scenarios (JA). Previous research showed a social effect on motor inhibition: a delay in stopping ongoing motor actions with others, relative to when conducting actions alone. This effect is presumably due to the need to representing both our own actions and those of our partner, thus delaying motor inhibition mechanisms. In this study, with the use of a humanoid robot, we explored the factors that contribute to this social effect on motor inhibition. We asked participants to perform a joint action task with another agent. Their task was to open a bottle held by a mechanical clamp or a partner (human or robot). On 33% of the trials, they heard a stop signal tone, which indicated that they needed to stop an ongoing action. In Experiment 1, participants performed the task with a humanoid robot, while in Experiment 2 with a human confederate instructed to not exhibit any social signals. In Experiment 3 (data collection ongoing), participants interact with a robot exhibiting social behaviors. Preliminary results indicate a delayed motor inhibition effect solely in Experiment 2, but not in Experiment 1, suggesting that only human partners impact motor inhibition. Experiment 3 should elucidate whether it is the social nature of the partner that drives the effect or whether the effect can be observed solely in human-human interactions.

Location: Cafeteria

Poster 38

The Acting Self: using fNIRS to measure the sense of self of actors whilst they perform a monologue

Dwaynica Greaves, Anastasia Kokkinou, Joachim Nicolodi, Antonia Hamilton

In this present study, we were interested in how performing a character may affect an actor's sense of self. One way to measure the sense of self is by measuring the mPFC's activation when hearing your own name compared to other names. Therefore, we measured actors' mPFC responses to hearing their own, character and stranger names during acting and non-acting conditions. 38 UK-based professional actors with 2+ years of industry experience participated. Shimadzu LIGHTNIRS functional near-infrared system with 22 channels was used to measure PFC activity. Biosignalsplux physiology system was used to measure breathing rate. Actors performed a monologue, coloured in a mandala colouring book, and read aloud from a telephone book. Each of these three tasks were conducted whilst seated, lasted 2 minutes and were repeated 4 times in the same listed order. During each task, the actor's first name, character name and a stranger's name were called out from a speaker at randomised time intervals between 17-22 seconds within 2 minutes. The entire session lasted 24 minutes. Our preliminary analysis revealed that own name had higher activation compared to stranger name in the mPFC during the monologue condition, but stranger name had higher activation compared to own and character name in control conditions in the L_IFG, L_DLPFC and the R_FPC. Our preliminary conclusion is that the novelty of the stranger name may have led to higher activation compared to own and character name in control conditions. The data is being reanalysed so concrete findings will also be discussed.

Location: Cafeteria
Poster 39

The impact of imprisonment on the sense of agency and outcome processing

Elodie Kox, Emilie Caspar

Prison is characterized by coercion and a reduction in the autonomy of inmates. This study investigates the hypothesis that significant reduction in autonomy, coupled with submission to a coercive framework during incarceration, may impede an individual's ability to regain control of their life after their release from prison. In this study, we investigated the impact of various types of prison regimes on the sense of agency and outcome processing among inmates. Participants were inmates recruited in Belgian prisons and were detained under different detention regimes including closed, semi-opens, and open regimes, each imposing distinct levels of coercion and restrictions on freedom. They were compared with free control participants who had never been incarcerated. Participants could inflict a financial pain to their co-participant, thereby increasing their own gain, either freely or following the orders of the experimenter. We measured the implicit sense of agency with the method of time interval estimates following each action, and auditory outcome processing was measured with the amplitude of the auditory N1, as previous studies showed that obeying orders reduces the neural processing of the outcomes of one's own action. Behavioural and electroencephalography results will be presented. These results will 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.

Location: Cafeteria
Poster 40

State-Dependent interactions between right inferior frontal gyrus and primary motor area during a Go/NoGo Task: a Paired Associative Stimulation study.

Naomi Bevacqua, Sonia Turrini, Antonio Cataneo, Matteo Candidi, Alessio Avenanti

Introduction: Motor inhibition requires suppressing inappropriate motor responses. Studies suggest that during motor inhibition tasks, the right inferior frontal gyrus (rIFG) indirectly influences the primary motor cortex (M1) via a cortico-subcortical pathway. Here, we investigate whether strengthening a direct cortico-cortical rIFG-to-M1 route affects behavioral and electrophysiological indices of motor inhibition.

Method and Results: We used transcranial magnetic stimulation (TMS) to induce associative plasticity within the rIFG-IM1 pathway using cortico-cortical Paired Associative Stimulation (ccPAS). In 2 sessions, we administered a ccPAS protocol aimed at strengthening short-latency rIFG-to-IM1 connections (ccPASrIFG-IM1) and a control protocol (ccPASIM1-rIFG). Before and after the stimulation, we recorded the motor inhibition performance with a Go/NoGo task and motor-evoked potentials (MEPs) to single-coil (IM1) and dual-coil TMS (rIFG-IM1) during observation of Go and NoGo stimuli. Only in ccPAS-responding participants (i.e., displaying “online” MEP changes during ccPASrIFG-IM1 administration), ccPASrIFG-IM1 induced distinct changes of rIFG-IM1 interactions: relative to single-pulse MEPs, dual-coil MEPs were enhanced in Go trials and suppressed in NoGo trials. The ccPASIM1-rIFG protocol did not affect MEP amplitudes. Meanwhile, both groups showed a similar increase in the Go/NoGo performance, irrespective of the ccPAS protocol.

Conclusion: These findings show that enhancing rIFG-to-IM1 connectivity in ccPAS-responding participants results in an enhanced state-dependent causal influence of rIFG over IM1, dynamically shifting from facilitatory to inhibitory depending on task demands. Therefore, while prior work has focused on cortico-subcortical pathways engaged in motor inhibition, here we demonstrate that a cortico-cortical rIFG-to-IM1 route can play a critical role in learning visuo-motor associations.

Location: Cafeteria
Poster 41

Investigating neural signatures of outcome anticipation in goal-directed behavior

Jasmin Stein, Hannes Ruge, Uta Wolfensteller, Clemens Kirschbaum, Thomas Goschke, Katharina Zwosta

Goal-directed decision-making is at the core of adaptive behavior. It is generally assumed that goal-directedness critically relies on anticipating the future outcomes of our actions. In this currently ongoing fMRI project (planned N = 60), we are investigating the neural basis of outcome anticipation using an instrumental learning task including selective outcome devaluation. In our experimental paradigm, participants are learning the deterministic associations between eight visual stimuli, manual responses, and specific visual outcomes (images of a house or face) followed by a monetary reward (high or low). Each learning block is followed by a devaluation block where one of the two decision outcomes (house or face) is selectively devalued, hence does not lead to the delivery of a monetary reward anymore. The rationale is, that behavior is considered goal-directed when behavior is adapted to the change in reward value. To assess neural signatures of outcome anticipation, we are planning to apply multivariate pattern analysis (MVPA) to decode anticipatory neural activation associated with the presented action outcomes as well as integrated response-outcome associations. In regions identified with MVPA, we will test for brain-behavior correlations, thus, for regions where encoding strength is correlated with performance in outcome devaluation trials, the behavioral marker of goal-directed decision-making. In line with previous research, we expect significant anticipatory outcome encoding in brain networks previously implicated in goal-directed behavioral control, e.g., in the dorsolateral and ventromedial prefrontal cortices, that is significantly correlated with task performance.

Location: Cafeteria
Poster 42

Shared perceptual decisions exhibit an animacy bias

Rebecca Geiselmann, Ophelia Deroy

The influence of the social context on perceptual decision-making in humans, particularly in discerning animacy, is a relatively unexplored area in cognitive research. Traditional studies often isolate participants, neglecting the potential impact of social factors on perception. This study investigates the effect of shared perception on animacy recognition, a critical ability for identifying living entities, which could represent prey, predators, or mates. Animacy is primarily inferred visually, with goal-directed motion being a prominent cue. We hypothesize that participants will exhibit a stronger bias (in terms of response frequency and speed) toward perceiving motion as goal-directed when in the presence of another individual engaged in the same task. We also aim to determine whether this shared context enhances accuracy in identifying genuine goal-directed motion. To test these hypotheses, we designed an experimental setup where participants judge short animations depicting motions with varying degrees of goal-directedness, both individually and alongside another person completing the same task independently. This design isolates the mere awareness of a shared experience from direct interaction or cooperation. The animations involve a blue disk seemingly chasing a red disk, with four gradations of chasing intensity. Participants respond after each animation, indicating whether a chase occurred. Our findings will compare individual versus shared perceptual decisions, shedding light on whether the presence of others biases human perception of animacy. This research bridges a significant gap in understanding how social contexts influence fundamental perceptual processes.

Location: Cafeteria
Poster 43

Error timing as a marker of reading skills: comparing Conditional Accuracy Function in lexical decisions between novice and expert readers

Fanny Grisetto, Adrien Lorant, Clémence Roger, Gwendoline Mahé

Reading difficulties affect about 20% of the population, despite regular schooling, and lead to social issues. As visual word recognition (VWR) is a major part of reading skills, our study explored error origins in a lexical decision task using Conditional Accuracy Functions (CAFs) to distinguish fast from slow errors.

Reading skills and related capacities of 42 adults and 62 children (28 in Grade 1 and 34 in Grade 2) were assessed. They also performed the lexical decision and Simon tasks. Electromyographic data were collected in children to provide more precise information on decision-making processes. Overall, differences in CAF patterns between adults and children were restricted to the lexical decision task, indicating their capacity to uncover markers of reading proficiency. In particular, fast errors were observed in pseudowords, but only in adults. Interestingly, faster pseudoword errors were associated with better reading skills. Errors in words were generally independent of RTs in adults. Slow errors in words were however observed in poorer adult readers, and were more pronounced in children at the start of learning (Grade 1).

In conclusion, fast pseudoword errors seem to characterize proficient reading, as errors arise from automatic activation of lexical representations of close words. On the contrary, slow word errors might reveal poor reading skills as they reflect insufficient lexical activation in a given time according to the Multiple Read-Out model. Our results suggest that detailed analyses of errors in lexical decision tasks contribute to identifying reading difficulties. Electromyographic data currently under analysis will complement the results.

Location: Cafeteria

Poster 44

Exploring the impact of cognitive conflict on subsequent cognitive processes

Manuela Ruzzoli, Marta La Pietra

Cognitive conflict is an effective trigger for control, flexible behaviour, and adaptation. It is considered effortful, detrimental to performance and affectively aversive. However, converging evidence also indicates that, when successfully resolved, cognitive conflict has positive consequences. Prior research has shown that conflicting stimuli can be rewarding, attract attention and improve memory performance. In this registered report (Stage 1 with In-Principle Acceptance), our goal is to examine if instances of cognitive conflict can positively impact subsequent cognitive processes and, therefore, human behaviour, contesting the assumption that conflict is inherently aversive and exclusively detrimental. To achieve this, we designed three independent experiments to investigate behavioural changes on subsequent tasks after congruent and incongruent Stroop items. If, as we hypothesise, performance after incongruent Stroop trials is better than after congruent trials, we will interpret it as a generalization of the evidence that cognitive conflict can benefit human behaviour on functions other than conflict adaptation.

Location: Cafeteria
Poster 45

Exploring people's preferences towards cognitive conflict

Marta La Pietra, Marc-Lluís Vives Moya, Nicola Molinaro, Manuela Ruzzoli

Cognitive conflict is characterized by discrepancies between a stimulus and simultaneously activated responses, interferences in decision-making, incongruence, surprise, uncertainty, and violation of expectations. Cognitive conflict is considered effortful and inherently aversive. However, this perspective overlooks the possibility that successfully resolving cognitive conflict can yield numerous positive outcomes, such as improved performance, enhanced memory, and a sense of reward. If cognitive conflict is inherently negative and aversive, as the literature suggests, participants would avoid it. In contrast, if participants prefer tasks with an intermediate or high level of cognitive conflict, this would endorse its potentially positive and stimulating nature. We used the Stroop task as a source of cognitive conflict and asked the participants (N=100) to decide how many incongruent/congruent Stroop trials they wanted to perform within one block. They then rated their enjoyment and mental effort on a 7-point scale and indicated their emotional state on an Arousal-Pleasantness grid. Results revealed a significant preference for intermediate and high levels of cognitive conflict over the low level. Participants engaging in higher conflict levels reported effortful yet enjoyable experiences and exhibited superior performance in response latencies and accuracy compared to those at lower levels of conflict. Our findings thus challenge the inherently aversive nature of cognitive conflict, highlighting its potential for positive engagement and enhanced performance, paving the way for a more nuanced understanding of the cognitive processes involved.

Location: Cafeteria
Poster 46

Neural Correlates of Ideological Cognition During Probabilistic Inference

Diamantis Petropoulos Petalas, Gijs Schumacher

The neural underpinnings of ideological cognition have been primarily investigated from the perspective of structural differences between liberal and conservative brains. However, political ideology can be much more diverse, while less is currently known about the functional qualities of ideological cognition and, specifically, how the activation of political ideology motivates reasoning and cognition. In this project we are interested in how ideological cognition (defined as a thinking style that is rigid and intransigent to evidence-based belief-updating and selectively relational towards specific social norms, ideas or groups) influences the way individuals evaluate new information from experience in order to update their prior beliefs and make advantageous behavioural decisions. Using a probabilistic inference paradigm, we investigate the neural underpinnings of the jumping-to-conclusions (JTC) bias, a behavior related to the tendency of some individuals to form judgements based on insufficient evidence. In addition, we study how individual differences in ideological cognition relate to behavioural performance and neural activity. Preliminary results from a pilot online behavioural (N = 458) and an EEG (N = 48) experiment show that information on political ideology can trigger differences in behavioural performance and in the neural processing of the stimuli used to update beliefs. We are currently collecting more behavioural data using a more representative sample, to test the hypothesis that ideological cognition causes behavioural and neural adaptations during probabilistic inference. Final results and implications for political ideology will be available and discussed in the ESCAN 2023 meeting

Location: Cafeteria
Poster 47

Neural dynamics of effort evaluation versus allocation

Nanne Kukkonen

Mental effort is often conceptualised as a decision-making problem: the inherent cost of effort is weighed against the incentives to expend effort. In most paradigms, effort evaluation is not separated from the preparation where the negative signals of effort evaluation are translated into positive signals of effort allocation to ensure successful task performance. For example, in effort and reward cuing studies, a high task demand can lead to an upregulation of effort, as indexed by the recruitment of neural structures underlying effortful control, especially when rewards are expected. In an fMRI study, we explored effort as a dynamic process involving both evaluation of reward and effort information, and allocation of resources based on this information. Participants completed a cognitive control task in which incentive level and demand level were combined in a factorial manner. A trial began with an 'evaluation cue' that informed the participants of the condition, prompting evaluative processing of the upcoming effort condition. This cue was succeeded by an 'allocation cue', which served to signal the preparation phase for the upcoming task. Neural activity was assessed during the evaluation phase and the allocation phase in predefined regions of interest. These regions, typically implicated in motivated effort paradigms, supported demand-related processing in the evaluation phase, while encoding reward information in the allocation phase. By conceptualising effort as a multi-stage, dynamic process, we were able to tease apart different stages and neural signatures of mental effort in evaluative and attentional control networks.

Location: Cafeteria
Poster 48

Causal evidence for task regulation by anterior cingulate cortex: an experimental study in patients with stroke in the frontal lobe

Joyce Oerlemans, Ricardo Alejandr, Dimitri Hemelsoet, Paul Boon, Veerle De Herdt, Clay Holroyd

Background and aims

The anterior cingulate cortex (ACC) is one of the largest riddles in cognitive neuroscience and presents a major challenge in mental health research. ACC plays a crucial role in cognitive control and goal-directed regulation of behaviour. However, physical damage to ACC seems to barely impair the putative functions that have been attributed to it. The aim of this study is to investigate the effect of ACC damage on execution of hierarchically-organized task switches. Additionally, we look at the impact of ACC damage on the amplitude of the Reward Positivity (RewP), an event-related brain potential (ERP) component that represents the electrophysiological impact of dopamine reward prediction error signals on ACC.

Methodology and results

Patients with frontal lobe stroke are recruited at Ghent University Hospital. Participants perform the coffee-tea task (CTT), a hierarchical sequence task, and the virtual T-maze task (vTMT) to elicit the RewP, the latter with simultaneous scalp EEG recording. Factorial analysis is used to investigate the behaviour during the CTT. The RewP is identified using ERP-analysis with a standard difference wave approach (two conditions: positive vs. negative feedback). The results (i.e. behaviour during the CTT and RewP amplitude) are correlated with lesion location using voxel-based lesion-symptom mapping (VLSM). We have currently recruited 74 patients; mean age 61 (± 14), 33 female. Seventeen patients (23%) have lesions located in the ACC. 40 participants (54.8%) successfully completed the CTT.

Conclusion

Results of the ERP- and factorial analysis correlated with lesion location using VLSM will be presented at the conference.

Location: Cafeteria
Poster 49

Use of working memory during reinforcement learning as reflected in frontal theta-band oscillations

Irene van de Vijver

Updating one's behavior based on the results of previous actions, or reinforcement learning (RL), has traditionally been attributed to prediction-error-based learning in the striatum. However, more recent evidence indicates that working memory (WM) also supports such learning when delays between learning experiences are short. Here, we investigated how WM use during RL is reflected in lateral prefrontal and medial frontal theta-band oscillations, which are known to be involved in WM and feedback processing, respectively. To this end, we measured EEG while young adults (19-25 y) performed a RL task in which they learned the correct stimulus-response associations by trial-and-error. Stimulus repetitions were separated by either short or long delays. We replicated the behavioral results that we previously found in older adults: learning was faster with short than long delays, while consolidation was better in the long-delay condition. Only in the short-delay condition performance correlated with individual WM capacity. Similarly, preliminary EEG results show that theta power during the choice period was larger in the short-delay than the long-delay condition at bilateral lateral prefrontal electrodes. However, theta power after negative feedback did not differ between delay conditions at either lateral or medial frontal electrodes. Thus, although choice-related theta power seems to reflect WM usage in the short-delay condition, so far we did not find evidence of post-feedback WM updating. Additional analyses will focus on comparing theta-band dynamics between different parts of the learning process, connectivity between lateral prefrontal cortex and other task-relevant brain areas, and the relation with consolidation success.

Location: Cafeteria
Poster 50

An Examination of Unsupervised Clustering Strategies with Application to the Human Amygdala

Niklas Leitner

The human amygdala has long been subject of extensive investigation, yielding numerous structural and functional models. In terms of functionality the amygdala is mostly associated with mechanisms underlying fear in both humans and animals. In vivo examination of the human amygdala proves more challenging than in animals, since functional magnetic resonance imaging (fMRI) group analysis underlies spatial inaccuracies which pose a challenge to the identification of functionally distinct subregions. This thesis aims to investigate the usefulness of two unsupervised clustering algorithms to obtain functional parcellations of the human amygdala and examines whether they prove as an effective method to find the optimal functional parcellation of the sample. It does so by comparing the functional connectivity (FC) of obtained subregions to FC yielded by the Jülich Brain Atlas. Analysis of high resolution resting state fMRI data of 123 individuals showed that the applied clustering algorithms were able to derive parcellations that are definitely comparable to the Jülich Brain Atlas. Deviations of structure occurred in the smaller centromedial and superficial amygdala. However, FC suggests that the subregions obtained by the clustering algorithms are a better fit to the fMRI data at hand. Although some inconsistencies with literature in terms of functionality remain, unsupervised clustering has proven to be a feasible method for obtaining functional parcellations of the human amygdala, which can be built upon in the future.

Location: Cafeteria
Poster 51

Influence of cognitive modulation by caloric labels on brain reward responses during oral administration of sugar versus non-caloric sweetener erythritol

Aleksandra Budzinska, Fabienne Teyssiere, Emilie Flad, Patrick Dupont, Bettina Bettina Wölnerhanssen, Anne Christin Meyer-Gerspach, Nathalie Weltens, Lukas Van Oudenhove,

The beneficial effects of substituting sugar with non-caloric sweeteners (NCSs) remain uncertain due to the mismatch between their rewarding sweet taste and lack of energy content. Functional magnetic resonance imaging (fMRI) studies indicate an influence of cognitive processes (e.g., beliefs, expectations) on reward processing of NCSs, thereby changing their rewarding properties. We compared erythritol, a natural NCS with satiating properties, versus sugar (i.e., sucrose) to measure the impact of cognitions about the caloric content on the brain responses and liking ratings.

We performed a within-subject, single-blind, randomized counterbalanced fMRI study in 30 healthy males (mean $\pm$ SD: age 23 ± 0.6 years, BMI 22.5 ± 0.3 kg/m²). Concentrations of erythritol were individually titrated to match the perceived sweetness intensity of a 16% sucrose solution. During the scan, sucrose and equisweet erythritol solution were delivered as 1 mL sips with either correct or purposefully incorrect "low-" or "high-calorie" labels. After each sip, participants rated sweetness liking. Water with a "water" label was a control condition. A 2x2 ANOVA revealed higher liking ratings for sucrose than erythritol ($p < 0.0001$), but no main effect of the label, nor substance-label interaction. General Linear Model analyses of brain responses at FDR $q < 0.05$ showed no differences between substance or label effects, nor substance-label interaction. We observed differences between each condition vs. water.

Liking ratings were lower for erythritol than sucrose, and they were unaffected by the caloric label. There were no differences in neural responses, except in comparisons with the control condition.

Location: Cafeteria
Poster 52

The combined effects of rTMS with a brief mindfulness-based practice on cognitive processing in healthy subjects

Eri Miyauchi, Masahiro Kawasaki

Our previous study which combined repetitive transcranial magnetic stimulation (rTMS) with electroencephalogram (EEG) demonstrated the effectiveness of using rTMS to the task-relevant location at the task-relevant stimulation frequency to modulate cognitive and behavioral performance in healthy subjects. In the previous study, we examined the frequency-dependent stimulation effects of rTMS on the speed of giving-up response to the problems which participants failed to solve, and ongoing oscillations by applying online rTMS to induce relevant frequency of theta band which was determined in advance. As a result, we observed changes in the behavioral response and theta amplitude. Though the changes were statistically significant, they were considered to be cognitively unnoticeable. To make non-invasive brain stimulation (NIBS) to be cognitively and behaviorally effective, recent studies suggest combining NIBS with cognitive interventions such as psychotherapy, especially for the treatment of psychiatric disorders.

In this preliminary study, we investigated the combined effect of online rTMS which targeted to improve attentional processing with a brief mindfulness-based practice. Mindfulness has been suggested to induce improvement in attentional processing. Performance of a form of sustained attention to response task and EEG data were collected both before and after practice. Our results suggest the possible usefulness of combined approach of TMS with psychological interventions on cognitive function.

*Location: Cafeteria
Poster 53*

Dopamine underpins time-of-day-dependent variation of human impulsivity and fat intake

Lara Ryan, Annabel Losecaat Vermeer, Luke Lloyd Longren, Charlotte Ohmer, Constanze Gärtig, Berthold Viktor Koletzko, Jeannie Horak, Achim Kramer, Andreas F.H. Pfeiffer, Andreas Michalsen, Olga Pivovarova-Ramich, Soyoung Q. Park

The dopaminergic system plays a key role in high-fat diet and impulsive behaviors. Importantly, plasma dopamine and its precursor tyrosine show a rhythm that is time-of-day dependent, decreasing across the day and reaching their lowest levels in the evening. Understanding the time-of-day dependency of dopamine regulating human impulsivity and fat intake is essential for potential intervention strategies, however evidence is lacking. Here we investigated time-of-day dependency of dopaminergic function in human behavior and food intake using three independent studies including healthy and pre-diabetic participants (N=172, N=28, N=28).

In the first observational study, we show that habitual fat consumption is higher in the evening compared to the morning. Our second cross-over within-subject experimental study confirms that fat intake in the evening induces a greater plasma tyrosine response compared to in the morning. This time-of-day difference in tyrosine metabolism is reflected in the individual's fat intake in everyday life, as those who habitually consume more fat in the evening also showed a more pronounced tyrosine response after fat intake in the evening. Finally, in the third cross-over intervention study, we shifted participant's mealtime to daytime-shift plasma dopamine and show its link to impulsive behavior in humans, as an underlying mechanism of fat-intake. Our results unveil the crucial time-of-day dependency of dopamine in human behavior and fat intake. Overall, we provide a novel perspective on how mealtime intervention can treat metabolic disturbance and obesity through optimizing human decision-making.

Location: Cafeteria
Poster 54

Causal Role for the dmPFC in Salience for Distant Others

Chloe Bates, Andrew Martin

The medial prefrontal cortex is associated with self-referential processing, with a ventral-to dorsal-medial gradient mapping self to other-referential processes. Previous research using transcranial direct current stimulation (tDCS) has identified a causal role for the dorsomedial prefrontal cortex (dmPFC) in increasing the salience of others, but it is uncertain whether this extends to close others, such as friends. Similarly, it is uncertain whether stimulation effects both memory accuracy and confidence.

50 young adults were stratified to receive either anodal or sham focus tDCS to the dmPFC in a double-blinded experiment. All participants responded to 60 trait adjectives, balanced for valence and arousal, rating how well they described either themselves, a close friend, or Boris Johnson. Subsequently, all participants completed a surprise memory test, requiring them to answer whether they had seen the adjective (item memory) and who it was tagged to (source memory). Participants also indicated their confidence for each memory. The 60 observed words were presented alongside 60 new distractor words.

A self-reference effect was identified with self-encoded words recognised better than both the friend-encoded and celebrity-encoded words. Friend-encoded words were also recognised better than celebrity-encoded words. Following anodal stimulation to the dmPFC, only memory for celebrity-encoded words was improved. Stimulation had no effect on source memory or on confidence levels.

Stimulation to the dmPFC improves memory for distant but not for close others. This suggests that close friends may be associated with a greater overlap in neural activity to that observed with self-referential processes.

Location: Cafeteria
Poster 55

Pupil reactivity and ocular exploration during the McGurk effect: influence of instruction, congruence and perception

Claire Wardak, Vivien Rabadan, Alix Lamarre, Nadia Aguillon-Hernandez, Marianne Latinus

Multisensory integration aims at constructing a unified representation of the external environment. When information from several sensory modalities are in conflict, an illusory perception can emerge to interpret as best as possible the situation, as in the McGurk effect. The aim of this study was to evaluate how information selection, via the analysis of gaze pattern, and physiological reactivity, via the analysis of pupil dilation, are influenced during the McGurk illusion.

39 adults were recorded with an eye-tracking system (Tobii Fusio 250Hz) during two experimental blocks. In the first block, they observed passively audio-visual videos of actors enunciating syllables. In the second, they observed the same videos but had to report which syllable they perceived. Auditory and visual contents of the videos could either be congruent or incongruent. Ocular exploration was assessed by quantifying the gaze time spent in Regions of Interests. Pupil reactivity was assessed by quantifying the amplitude and latency of pupil peak dilation. Statistical analyses focused on the effect of instruction (passive vs. choice), congruence, and perception (auditory input, visual input, or fusion).

Pupil reactivity was sensitive to all parameters. Attentional engagement in the active block induced an overall larger pupil dilation. Moreover, incongruence also led to a larger pupil dilation and an increased fixation on the mouth, but mainly in the active block. Relationship with the percept was more complex. These results suggest that pupil and gaze are very sensitive to the conflict between auditory and visual inputs, while being also modulated by top-down information.

Location: Cafeteria
Poster 56

Neural mechanisms of attentional integration and selection

Blanca Aguado-López, Ana F. Palenciano, María Ruz

Every day we face many stimuli, some of which we need to select whereas other need to be integrated with other information. While previous research has studied integration and selection separately, a detailed comparison of the neural representation of stimuli in these two types of contexts has not yet been made. In this experiment we collected EEG data in a cue-target paradigm to examine how information coding unfolds temporally as a function of the cognitive demands of selection vs. integration. Our planned neuroimaging analyses focus on multivariate analysis (MVPA). First, we will conduct decoding on the cue activity to examine the nature of the preactivations generated by the tasks. Then, we will perform a representational similarity analysis (RSA) in the cue and target interval to examine the dimensions (i.e. task, category, response and perceptual coding of the cues) that structure the information in a proactive and reactive manner. Next, we will explore if the relationship between the stimuli to segregate or to integrate depends on the task context. Further analyses will examine the extent to which the preparatory activity pre-activates stimulus perceptual information and whether it differs according to the task, using a Canonical Template Tracking (CTT) approach. Finally, we will explore the relationship between the behavioral and neural indexes. Our results will contribute to the understanding of how task demands alter the neural representation of information during preparation and target processing stages.

Location: Cafeteria
Poster 57

Modelling the onset and duration of motor imagery: Assessing a novel algorithmic model of motor imagery

Ladislav Nalborczyk, Marieke Longcamp, Elodie Lévêque, Thibault Gajdos, Mathieu Servant, F.-Xavier Alario

Behavioural, electrophysiological, and neuroimaging evidence suggest that the motor system is involved in simulating motor execution during motor imagery. This raises the "problem of inhibition of execution": Given the involvement of the motor system, how is it possible for motor imagery not to lead to motor execution? This may be achieved by upregulating the motor execution threshold; alternatively, parallel inhibitory processes may prevent execution during motor imagery. These proposals have been formulated as verbal theories, often insufficiently specified at the algorithmic level and implementable in several formal models whose predictions may concur or conflict. We developed an algorithmic toy model of the inhibitory mechanisms presumed to be at play during motor imagery and used it to clarify the predictions from competing views. In this model, a simplified overarching description of how the motor system is involved over time during motor imagery is used to predict the onset and duration of imagined actions. We fitted this model to several behavioural datasets collected in motor imagery tasks and assessed the reliability of its estimates via an extensive parameter recovery study. This analysis shows that the implemented motor upregulation hypothesis is incompatible with the data. We further show that distinct inhibitory mechanisms may be disentangled according to their behavioural consequences. In addition to providing an excellent fit to extant data, this model generates several novel predictions, thus opening new avenues for research on the neural and cognitive mechanisms supporting motor imagery. The model is available as an R package at: <https://github.com/lNALBORCZYK/momimi>.

Location: Cafeteria
Poster 58

Uncovering the neural dynamics of silent reading and ticker-tape synesthesia

Ladislav Nalborczyk, Fabien Hauw, Hermine de Torcy, Stanislas Dehaene, Laurent Cohen

The ability to voluntarily form mental images of communicative acts (e.g., imagining a conversation) is essential to human activities such as reading, planning, or remembering. However, visual or auditory mental images may also be elicited automatically (without intention). For instance, some persons see mentally in print every word uttered with varying shape, size, or colour, a phenomenon coined ticker-tape synesthesia (TTS). Similarly, attentive silent reading leads (in most people) to the impression of hearing an "inner voice" very similar to the voice heard during speech perception. However, the neural mechanisms leading to these mental visual or auditory percepts are still unclear. We sought to resolve this by employing magnetoencephalography with time-resolved cross-temporal and cross-modal multivariate pattern analyses (or decoding) in control and synesthete participants. We presented participants with five categories of words that varied in orthographic length (number of letters) or phonological length (number of syllables). We predicted that orthographic length should be decodable to a greater extent following auditory input in synesthetes than in control participants, and we sought to characterise the onset and durations of these visual mental percepts in synesthetes. As predicted, preliminary results suggest that orthographic length can be decoded well above chance in TTS participants, as soon as 100ms after stimulus onset. Overall, these preliminary results support the view of TTS as upended reading and shed light on the precise timecourse of its neural underpinnings.

Location: Cafeteria
Poster 59

Stop me, if you can! The neural bases of action control in emotional context: a Transcranial Magnetic Stimulation study

Lorenzo Però, Claudio Nazzi, Chiara Di Fazio, Nicolò Arlati, Simone Battaglia, Sara Borgomaneri

Emotional stimuli are known to influence motor response inhibition. Action control capabilities can be assessed using the Stop Signal Task (SST), which requires participants to withhold their motor response after the presentation of a stop stimulus, and measures inhibition through the Stop Signal Reaction Times (SSRT). Literature suggests that the pre-supplementary motor area (preSMA), the right inferior frontal gyrus (rIFG), and the primary motor cortex (M1) are all crucially involved in action control. However, no existing studies have investigated their role in action control in an emotional context. 60 healthy participants performed a modified version of the SST, in which emotional and neutral body postures were presented as stop stimuli. In different groups of participants, the SST was performed before and after the administration of one session of repetitive Transcranial Magnetic Stimulation (rTMS) over the pre-SMA, the rIFG, and the left M1. rTMS targeting pre-SMA improved action control (shorter SSRT) for emotional stimuli, while rIFG inhibition enhanced control for neutral stimuli. No significant effects were observed with M1 stimulation. Intriguingly, individuals with higher impulsivity traits exhibited enhanced motor control when facing neutral stimuli following rIFG stimulation. These results further our understanding of the complex interplay between emotions and motor functions, shedding light on the selective modulation of neural pathways underpinning these processes.

Location: Cafeteria
Poster 60

Reward Prospect vs. Reception: Dynamic Effort Adjustment vs. Stable Performance

Martin Kolnes, Rebecca Calcott, Henk van Steenbergen, Gesine Dreisbach

Performance-contingent rewards are known to enhance cognitive effort and overall task performance. However, the specific reward components responsible for driving these effects and their impact on sustained effort in the absence of rewards remain unclear. We explored the contrasting effects of two performance-contingent reward components: Reward Prospect (the opportunity to earn a reward) and Reward Reception (knowledge of having earned a reward). Participants engaged in a Simon task, receiving distinct reward information during each trial. The Prospect group was informed about Reward Opportunities but received no trial-level feedback, while the Reception group lacked information about Reward Opportunities but received feedback upon earning a reward. In Experiment 1, the Prospect group showed faster responses on trials with Reward Opportunities but slower responses following rewarded trials. In contrast, the Reception group did not exhibit this trial-by-trial modulation of response time. Experiment 2 replicated these effects and showed associated changes in cognitive effort, as indicated by pupil dilation. These findings suggest that information about the Prospect of performance-contingent rewards promotes cognitive effort when rewards are available but paradoxically diminishes it immediately after earning a reward. In contrast, information about reward reception does not lead to trial-to-trial adjustments but results in a more stable task performance.

Location: Cafeteria
Poster 61

Retrospective effects on sense of agency do not reflect a self-serving bias: a cognitive and EEG study

Natasha Scott, Andrew Martin

Sense of Agency (SoA) refers to the experience of control over our everyday actions and their subsequent outcomes. SoA is dependent upon prospective factors (e.g., action choice) and retrospective factors (e.g., outcome valence). Positive outcomes result in greater SoA, and so, are thought to reflect a self-serving positivity bias. The present study tested this claim by assessing whether SoA is greater when rewards are directed at the self rather than another person. Participants (n=48) completed a “Libet clock” task in which was used to assess the influence of choice (choice, no choice) and outcome valence (rewarding, punishing outcome) to either the self or another person on SoA. Implicit SoA was measured through intentional binding reflecting the perceived temporal compression between an action and outcome, and electroencephalography data was also collected. Whilst our results show main effects of choice, outcome, and recipient on SoA, we show no evidence of a self-serving bias, such that receiving a reward for the self and another person equally enhanced intentional binding. Furthermore, our results revealed evidence of the roles of Feedback Related Negativity (FRN) and P300 (P3) on the processing of negative and positive outcomes, respectively. These findings provide important insight into how we might attribute agency for actions that not only benefit ourselves but also those around us and negate claims of a self-serving bias relevant to retrospective accounts of our sense of agency.

Location: Cafeteria
Poster 62

Testing the stability of Anterior Cingulate Cortex (ACC) task representations: doing sequential tasks in a separate versus interleaved fashion

Iris Ikink

The anterior cingulate cortex (ACC) is known to represent behavioral states, including hierarchical sequential task action states (Holroyd et al., 2018). However, it remains unknown how stable such task representations are. Here, we investigated to what extent these representations are maintained when the steps of two different sequential tasks are interleaved. While in the scanner, participants (N=50) performed two sequential 6-step tasks in either a single (stand-alone) or interleaved fashion (e.g. doing step 1 of task1, step 1 of task2, step 2 of task1, step 2 of task2, etc.). Using a predefined ACC-RoI we then conducted multivariate representational similarity analyses (RSA) and ran follow-up analyses on the obtained participant-specific similarity values. As expected, the ACC encoded both task and condition information, by showing higher representational similarity between steps within-task/-condition than between-task/-condition. Similarity values across within-task steps were also significantly correlated between the single and interleaved condition ($r=.18$), indicating that ACC task representations were partly maintained. Further, steps of the more difficult task and more difficult (interleaved) condition showed higher representational similarity to each other than those of the less difficult task and condition (significant and trend effect, respectively). Lastly, the extent of increased similarity in the interleaved versus single condition correlated with better performance. To conclude, neural representations in the ACC are partly maintained when doing two sequential tasks in single versus interleaved fashion, indicating stability in neural task representations. Further, increasing difficulty resulted in somewhat less distinct representations, and the strength of this effect correlated with people's performance.

Location: Cafeteria
Poster 63

Neural bases of the facial imitation of auditory smiles – a work in progress

Camille Des Lauriers

In a spoken interaction, listeners mimic smiles perceived in the speaker's voice even when they don't consciously recognize the voice as smiling (Arias et al., 2018). However, empirically, facial mimicry is typically only observed in active tasks involving emotional evaluation (Murata et al., 2016).

This facial mimicry suggests a complex form of cognitive processing involving among other, the sensorimotor areas and the social cognitive and emotional networks linked to social communication. However, the neural bases of this unconscious facial imitation elicited by emotion in voice remain largely unknown.

The aim of this project is to dissociate the smiling mimicry elicited by a consciously detected smile in the speaker voice from the facial imitation elicited without a conscious recognition of it. To achieve this, we are collecting behavioral data, along with facial electromyography (EMG) evaluating zygomatic and corrugator activities, coupled with electroencephalography activity recorded from healthy participants. The task consists in an active listening of sentences where participants judge the smilingness of them. This paradigm creates situations of miss trials (smiling stimuli not detected as such) and false alarms (non-smiling stimuli wrongly detected as smiling).

Presentation will discuss preliminary analyses of data collected this fall. From previous literature, we expect to find 10-15% false-alarm and miss trials. Zygomatic EMG is expected to be activated during hits and misses, but not false alarms and correct rejections; conversely, corrugator EMG should be deactivated during hits & false alarms, but not misses and correct rejections.

Location: Cafeteria
Poster 64

Outsourcing goal pursuit to AI agents and downstream consequences for human motivation and agency

Livia Reguş, Ruud Custers, Hyunji Kim, Henk Aarts

For a long time, humans have set and pursued goals in interaction with others. However, the integration of Artificial Intelligence (AI) into personal goal-setting processes represents a paradigm shift, potentially reshaping foundational aspects of human motivation and agency. This poster will present a research program aiming to investigate the psychological consequences of outsourcing goal-setting to AI, focusing on the inherent affective-motivational processes guiding human behavior. First, we employ a novel behavioral approach, according to which participants engage in a task where choices to earn monetary rewards are made by the participant self or by an AI agent. Choices of reward are in both conditions equal in value. Next, they perform a mathematical test to earn the reward. We measure actual performance and psychological concepts such as perceived motivation, affect, effort, and agency. While the initial stages are behaviorally focused, future directions include biosignal measurements (e.g., pupil dilation or cardiovascular measurements) to gauge effort and engagement more deeply. The general hypothesis is that when our goals are set by AI agents, we are less motivated to achieve them compared to setting the very same goals ourselves. The task allows to study several moderators to align AI with the self in the context of social interaction. Although results are pending, preliminary findings will inform the theoretical understanding of how human-AI interactions alter the psychological landscape of goal-setting. I will also pave the road to a framework for developing AI systems that support rather than undermine human motivational dynamics and well-being.

Location: Cafeteria

Poster 65

Role of transcranial magnetic stimulation in understanding the mechanisms modulating cognitive processing by emotion: A systematic review

Cristian Cortés-Rivera

Transcranial magnetic stimulation (TMS) is a technique that allows us to causally explore the behavioral-cognitive response to in situ modulation of cortical activity. To date, most studies with TMS have focused on the domains of attention regulation, executive control, and decision-making, without exploring how these domains are modulated by affective variables. The present systematic review aims to analyze the research designs and response variables that have been modulated through simultaneous TMS and emotional induction protocols. To this end, a systematic review of the literature published up to August 2023 was conducted, guided by PRISMA and its methodology (Page et al., 2020). Boolean terms were established to run the search in three electronic databases: Web of Science, Scopus, and Pubmed. Inclusion criteria included experimental studies using TMS and emotional induction as independent variables, in human populations of all ages, and comparing the types of design, participant characteristics, and behavioral and cognitive response variables. As exclusion criteria, we considered studies that do not consider TMS and emotional induction simultaneously and studies where TMS is used for treatment purposes. We find that the use of the TMS contributes as a necessary technique to provide causal explanations about the involvement of cortical structures and behavioral responses modulated by emotional induction protocols.

Location: Cafeteria
Poster 66

Distorted Size Perception: Investigating the Role of Emotions and Personality

Amandine Guillin, Laurence Chaby, Dorine Vergilino-Perez

Human behaviour is fundamentally driven by the pursuit of goals and the avoidance of threats (Carver & Scheier, 1998). These motivational forces are supported by action tendencies, which are believed to shape visual perception by either reducing (approach tendencies) or increasing (avoidance tendencies) the perceived spatial distance between oneself and the localised goal or threat (Balcetis, 2016; Balcetis & Dunning, 2006). Although it is well-established that emotional stimuli may induce approach-avoidance tendencies, resulting in the perception of reassuring or threatening faces as closer than neutral faces (Kim & Son, 2015), and positive words as larger in size than neutral or negative words (Ode et al., 2012), the impact of these action tendencies on the visual perception of neutral stimuli after exposure to emotional stimuli remains largely unexplored. Additionally, the influence of personality traits on these processes has received limited attention. For the needs of this study, we conducted three experiments to explore the priming effect of emotional stimuli (e.g., anger, happiness, or disgust in faces and words) on size estimations of neutral stimuli (e.g., squares), while also examining potential moderating effects of personality. Our results offer valuable insights into the phenomenon of size distortions in emotionally primed neutral stimuli, highlighting the intricate and robust interplay between emotional priming and visual perception. The moderating role of personality traits in shaping these perceptual distortions is also discussed.

Location: Cafeteria
Poster 67

The Emotion Authenticity Recognition (EAR) test to evaluate emotion recognition in male incarcerated offenders

Chiara Gramegna, Cristina Scarpazza, Enrico Capuzzi, Alice Caldiroli, Massimo Clerici, Nadia Bolognini

Social cognition refers to the information processing underlying various social abilities, such as the detection of others' emotions and the choice of an appropriate response to these emotions. Impairments in social cognition often arise from the incapability to interpret emotional states and can also affect the ability to discriminate between authentic and posed emotions. In this study, twenty-five male incarcerated offenders and twenty-five male controls, matched for age and educational level, underwent a newly developed Emotion Authenticity Recognition – EAR – test, which can be used for both recognition and discrimination of authentic and posed emotions. Offenders showed a significantly lower score than controls selectively for the Emotion Recognition Index ($t_{48} = 2.64$, $p = .006$), used to differentiate among the six basic emotions. Specifically, offenders had a worse performance in the recognition of negative emotions such as fear ($t_{48} = 3.07$, $p = .002$), disgust ($t_{48} = 2.86$, $p = .004$), and sadness ($t_{48} = 1.79$, $p = .041$) compared to controls. No significant differences were found for the discrimination between authentic and posed emotions ($t_{48} = 1.38$, $p = .087$). Taken together, our results are in line with previous findings, suggesting that offenders may have a specific deficit in recognizing facial expressions that convey negative emotions.

Location: Cafeteria
Poster 68

Does Alexithymia modulate the subjective interpretation of emotional arousal?

Nicola van rijnsbergen, Joe Pearson, Ralph Pawling, Felicity Wolohan

Arousal and Valence are frequently treated as independent dimensions of subjective emotional experience (Russell 1982). However, the ability to parse arousal and valence as separate aspects of emotional experience may depend on an individual's level of insight into their emotional states. Since estimating arousal requires individuals interpret their physiological responses to emotional stimuli, we hypothesized that Alexithymia (a measure of self-rated internal blindness to emotions) may influence the effect of arousal on perceived valence.

163 participants completed three tasks online (pavlovio.org): (1) rating visual and audio stimuli (social and non-social) for valence and arousal; (2) RMET; (3) facial emotion recognition. Participants also complete questionnaires measuring Alexithymia (TAS-20), emotional reactivity (PERSpos&neg), Autistic traits (AQ50) and Depression (CESD)

The effect of arousal on perceived valence fit better as a linear, rather than quadratic relationship. The IAC minimum model of the LMEs (R, lmer4) showed a significant interaction ($F = 9.0$, $p = 0.003$) between TAS-20 and arousal, where higher scores on the TAS-20 increased the positive association between arousal and valence. There was no interaction of arousal with AQ. There was also an interaction between the TAS-20 ($F = 8.0$, $p = 0.005$) and the sociality of the stimuli, with low TAS-20 reporting social stimuli as more pleasant than non social stimuli. Additionally, although most of the performance on the RMET task was explained by emotion recognition ability, this was modified by TAS-score. Our data suggest the TAS-20 is a sensitive indicator of divergence in interpreting significance of 'arousal' in emotional experience.

Location: Cafeteria
Poster 69

Beyond the "Mona Lisa Smile" effect : behavioral and neuroelectrophysiological evidence for the influence of context on emotional recognition.

Monica Toro, Claudia Pizarro, Francisco Ceric

BACKGROUND AND AIMS: "The Mona Lisa" by Leonardo da Vinci has been studied extensively due to its enigmatic smile and the multiple interpretations it has elicited. Despite our ability to recognize faces, fully understanding the emotion conveyed requires considering context. This study focuses on analyzing emotional recognition in facial expressions and contextual images, including visual and auditory perception in more ecological contexts.

METHODS: Two levels of complexity will be addressed: behavioral and electrophysiological (EEG). To analyze the behavioral level, a repeated measures anova between conditions will be performed for each experiments. At the physiological level, a between-group analysis will be performed for the following evoked potentials: N100, N200, P300 and N400.

RESULTS: The findings will provide theoretical information on the role of facial expression in emotional recognition in natural contextual situations, thus, to understand the expression of another, taking the Mona Lisa as an icon, the context in which a facial expression is situated is necessary. They will also contribute to empirical knowledge of emotional processing at the brain level, comparing both levels of complexity with behavior.

CONCLUSIONS: These results could influence the future development of emotional recognition instruments or programs from infancy to adulthood that will allow strengthening aspects of emotional regulation that to date have been diminished in society.

Location: Cafeteria
Poster 70

Emotion control training enhances reappraisal success among individuals with reported ADHD symptoms

Revital Hamerman

Individuals with attention deficit hyperactivity disorder (ADHD) experience difficulties in cognitive control and emotion regulation. Based on this phenomenon, we explored whether individuals with reported ADHD symptoms and controls may benefit from training that recruit cognitive control before exposure to negative pictures. Specifically, we assessed whether such training enhances the propensity to use reappraisal and reappraisal success. Therefore, 102 individuals reporting high ADHD symptoms and 91 controls were randomly assigned to one of two training conditions: high emotion control (H-EC) and low emotion control (L-EC). In the H-EC, negative pictures were typically preceded by a stimulus that recruits cognitive control. In the L-EC, negative pictures were typically preceded by a stimulus that does not recruit cognitive control. Participants were then asked to recall an adverse personal event and to reappraise the event. The findings confirmed our predictions, showing that instructed reappraisal was more effective in reducing negative mood in the H-EC training compared to the L-EC training. Furthermore, compared to controls, individuals with reported ADHD symptoms showed a greater propensity to use reappraisal after writing the event and a more considerable reduction in event significance and negativity following the instructed reappraisal assignment. Therefore, the findings suggest that employing cognitive control over emotional information has a causal role in reappraisal use and success among individuals with ADHD symptoms.

Location: Cafeteria

Poster 71

Sonifying tactile interactions and their underlying emotions: experimental studies and applications in virtual reality

Malika Auvray, Alexandra De Lagarde, Fabien Boucaud, Louise Kirsch, Indira Thouvenin, Catherine Pelachaud

With the increase of social isolation and distant communication, it appears timely to allow distant socio-affective interactions. To do so, we developed a methodology combining the use of a novel sonification technique that considers skin as a singular sonic texture and prototypical social touch gestures. Three studies explored the feasibility of this technique, its core components, and its potential application in virtual reality. In the first study, the vibratory signals from prototypical skin-to-skin touches were recorded with a violin microphone, allowing their conversion into sounds. The resulting sonified signals were presented to participants who were able to accurately categorize both the different gestures (stroking, rubbing, tapping, hitting) and their underlying emotional intentions (love, empathy, joy, impatience, fear, anger). The second study investigated the respective roles of rhythm and textural properties on participants' abilities to recognize social touch through sounds. The same tactile gestures as in the first study were reproduced with two different surface conditions: skin-to-skin and object-to-object. The results revealed that the dynamics of the surface involved is crucial and hence that skin-to-skin interactions bear information that sets them apart from object-to-object movements. The third study was conducted with the platform of virtual agents Greta, which allows simulating 3D touch gestures. We quantified the participants' differences in perceiving the virtual agent when performing a game involving or not social touch by the agent to convey emotional intentions. These results pave the way for social touch at a distance both with humans and with virtual agents.

Location: Cafeteria
Poster 72

The Role of Subjective Valuation and Affective Processes in Joint Action

Uma Navare, Marwen Belkaid

Whether foraging for food or planning a holiday, the process of choosing between options based on their value is pervasive in animal behavior. Moreover, substantial work shows that such valuation is subjective and depends on goals, emotions and context. Thus, one person's optimal holiday destination may differ from that of another person. What are these people to do then, when planning a holiday together? To answer this question, one must understand how subjective valuation and decision-making work in joint action, when people must coordinate to achieve a shared goal. However, despite joint action being pervasive in human life, little previous work has investigated how value and reward, and affective factors in general, shape decision-making in joint action. Within this context, we will present an initial planned experiment in which we will investigate how value-based decision-making is shaped by differences in the partners' available rewards. Given that in joint action people integrate their partner's effort, goals and intentions into their own action planning, we expect differences in the partner's available rewards will also affect their decisions. Moreover, we will use computational models of reward-based decision-making to test theoretical accounts of subjective valuation in the context of joint action. Thus, this study will be the first step in understanding how subjective valuation operates in joint action. More generally, our goal is to contribute novel knowledge on the role and implications of affective processes in joint action, which remains a crucial yet understudied question.

Location: Cafeteria
Poster 73

The role of intermediate emotional states in affective forecasting

Veronica Domenici, Giada Lettieri, Giacomo Handjaras, Luca Cecchetti

People can predict future emotions when all they know is the current state. However, complex temporal interdependencies between emotions exist. For instance, in daily life, the transition from anger to joy is unlikely, but not so if surprise occurs between them. Moreover, chains of emotions may exhibit substantial asymmetries: it is more likely to shift from one state to another than the opposite.

Here, we explore the role of intermediate states in determining the probability of transition from one emotion to another.

Thirty participants (20F, 26 ± 2.9 yrs) rated the transition probability of 392 chains of emotions (e.g., from joy to sadness passing through anger) on a scale from 0 to 100 (i.e., extremely unlikely/likely), with 50 indicating uncertainty. For each triplet, the significance of the transition was tested against uncertainty, and asymmetries were assessed by comparing the probability of each chain to its opposite (i.e., from A to B to C versus from C to B to A).

Overall, intermediate positive states, more than negative, promote the transition to emotions with similar valence regardless of the starting state. That surprise is fundamentally neutral well explains that any state, regardless of its valence, can be reached by passing through it. Asymmetry analysis reveals that joy is the target state after consecutive instances of fear and relaxation, while the opposite is not likely.

In summary, mental models of emotion transitions can track complex dynamics between states and probability judgments depend on the knowledge of the temporal characteristics of emotions.

*Location: Cafeteria
Poster 74*

Autonomic thermal signatures of (dis)honest response preparation in mindfulness trained practitioners

Giorgia Ponsi, Sara Sorella, Alessio Matiz, Cristiano Crescentini, Maria Serena Panasiti, Salvatore Maria Aglioti

Recent research suggests that mindfulness meditation may affect moral behavior by decreasing self-serving dishonest behavior, reducing instrumental harm and preventing the moral slippery slope (i.e., the decline of moral preferences over time). Evidence about the mechanisms through which this moral enhancement may take place is lacking. A recent study found that moral behavior change seems to be linked to increased awareness of bodily and emotional signals. To clarify the role of bodily signals in affecting deceptive behavior, we will employ functional Infrared Thermal Imaging (fITI), a technique that allows for the recording of skin temperature by tracking non-invasively emitted infrared heat. Mindfulness trained practitioners with various levels of expertise and control participants (matched for age, gender and education) will participate to the Temptation to Lie Card Game (TLCG), while their face temperature will be recorded by means of fITI. In the TLCG, participants will be free to decide whether to lie or tell the truth to an opponent player during a card game. In this version of the task, they will have to wait 5 seconds before pressing one of two keys, employed to communicate the opponent the outcome of the game (and to potentially reverse the outcome to their own advantage). We will analyse temperature data in this 5-seconds time frame, to test whether increased nose temperature will index parasympathetic system activation before deception, as shown by previous research. This study will allow to explore whether mindfulness expertise affect the autonomic signatures of (dis)honest response preparation.

Anxiety and Reciprocity Decisions: Unveiling Psychological Mechanisms through Computational Modeling and Eye Tracking

Huihua Fang

Background: Reciprocity decisions in social interactions are complex, influenced by core personal inclinations and contextually driven peripheral elements. The impact of anxiety on these decisions, particularly on psychological and neural mechanisms, remains largely unexplored. This study investigates how anxiety affects distinct aspects of reciprocity decision-making.

Methods: Participants with high and low levels of trait anxiety were recruited for this study. A binary trust game, employing both gain and loss frames, was utilized alongside eye tracking and computational modeling analysis.

Results: Computational modeling reveal that anxiety influences reciprocity decisions predominantly through guilt aversion, a core component resilient to framing change. Additionally, anxiety interacts with framing to affect decisions via inequity aversion and reward sensitivity. Eye-tracking data further corroborates these results, showing that individuals with higher guilt aversion spend more time focusing on guilt comparison areas. Conversely, those with greater reward sensitivity pay more attention to reward comparison areas, particularly under loss framing, but not in gain scenarios.

Conclusions: This study delineates the multifaceted nature of reciprocity decision-making, highlighting the role of guilt aversion as a stable element amidst fluctuating social contexts. It also sheds light on how trait anxiety modulates social interaction dynamics. These insights not only deepen our understanding of the interplay between psychological states and decision-making processes but also open avenues for further exploration in the realm of social neuroscience.

Location: Cafeteria

Poster 76

Metacognitive confidence and affect - two sides of the same coin?

Alan Voodla, Andero Uusberg, Kobe Desender

Decision confidence is a prototypical metacognitive representation as it has been shown to track the probability that a decision is correct in various computational models and experiments. Confidence has also been associated with affective valence, such that higher confidence is associated with more positive affect and vice versa. This suggests that similarly to confidence, in decision-making contexts affect could be a metacognitive signal reflecting the probability that a decision is correct. We tested this proposal in 2 perceptual decision-making experiments, where we investigated confidence and affect ratings in response to the probability that a decision is correct manipulated via expected and actual task difficulty. The findings indicate that confidence and affect ratings both track the probability that a decision is correct. We discuss various mechanisms and future directions that could clarify the cognitive and affective aspects of confidence.

*Location: Cafeteria
Poster 77*

Seeing emotions in the eyes: a validated test to study individual differences in the perception of basic emotions

Maria Franca, Nadia Bolognini, Marc Brysbaert

Emotion recognition is a fundamental ability that drives us in social relations; deficits of emotion recognition are common in psychiatric and neurological conditions, negatively impacting social cognition. Eyes, in particular, offer crucial cues to infer others' emotions and internal states. However, a solid test with good psychometric features to assess the ability to recognize basic emotions from the gaze of others is still lacking.

Here, we presented two studies (in total 558 participants) performed on Qualtrics, aimed at developing and validating a new test of emotion recognition from pictures of eyes: the Seeing Emotion in the Eyes test (SEE). We started with 315 stimuli (frames of eyes extracted from the RAVDESS database): in Study 1 we investigated reliability; in Study 2 the focus was on construct validity.

After the statistical analyses, we selected the best 48 items and developed SEE-48, which measures the six basic emotions (anger, disgust, fear, happiness, sadness, surprise) with 8 stimuli for each, balanced for actors' gender and matched in terms of items difficulty and discrimination capacity. It shows high reliability ($\alpha=.87$ and Omega T= .90) and it is significantly correlated with the Reading Mind in the Eyes Test (.49) and Situational Test of Emotional Understanding (.46), but not with tests that measure anxiety and apathy.

These results confirm that the SEE-48 has both convergent and divergent validity and, finally, they suggest that it measures not only low-level perceptual skills but also broader skills of emotion perception and emotional intelligence.

Location: Cafeteria
Poster 78

Electrical neuroimaging reveals dissociable effects of threat and goal-relevance on emotional face processing

Xiaojuan Xue

Using 64-channel EEG and an advanced topographic ERP mapping analysis in 37 adult healthy participants, we carefully analyzed the processing of peripheral fearful (vs. happy) faces embedded in a dot-probe task where they were either unattended or attended because of being directly task-relevant. The use of peripheral vision by the participants was confirmed using eye-tracking. Results showed that the structural encoding of the faces, as reflected by the N170 component, was stronger for fearful than happy faces, yet irrespective of task relevance. Interestingly, following this early stage, a distinct topographical map was identified that showed sustained emotional face processing when the face was task relevant compared to when it was not, regardless of the valence of the face. These results suggest the existence of dissociable neurophysiological effects of emotional attention and goal relevance during face processing. Although the former one can influence early stages of face processing in an automatic manner, the latter one suggests that goal relevance can increase emotional processing generically during a later stage of processing. More generally, these results suggest that value (i.e. threat) and goal can influence face processing via different mechanisms and they are interpreted using the notion of an attentional priority map where these two components can each contribute to it.

*Location: Cafeteria
Poster 79*

Roll & Tell: a mobile application for smartphones to study how bodily self-consciousness influences dishonest behavior in digital social interactions

Luca Provenzano, Marina Scattolin, Giuseppina Porciello, Maria Serena Panasiti, Salvatore Maria Aglioti

Studies suggest that bodily self-consciousness (BSC) significantly influences dishonest behavior. We found, for example, a positive correlation between the sense of ownership (SoO) and sense of agency (SoA) and individuals' moral identity. Given the ongoing digitalization of our social interactions, a crucial question is how these transformative technologies influence BSC and, consequently, dishonesty.

To address this question, we asked 43 participants to play 60 matches of an online dice game using the "Roll & Tell" smartphone app, specifically developed for this study. Each match involved participants rolling a virtual dice for 10 turns and reporting the outcomes to their opponent. The round's winner was determined by the player reporting the highest outcome, regardless of the actual dice roll. Reporting the same outcome resulted in a loss for both players. The overall match winner was determined by winning the majority of rounds. Furthermore, the top three participants in the global ranking received an additional reward. Therefore, participants could increase their chances of winning by dishonestly reporting a higher outcome than the actual dice roll outcome.

For each trial, we considered the difference between the real and reported dice roll outcome as a measure of dishonesty. Individual SoO and SoA were assessed through self-reported questionnaires.

Our findings indicate a positive correlation between ranking position and dishonesty, with better positions associated with increased dishonest behavior. Additionally, the data reveal a negative correlation between SoA and dishonesty, suggesting that feeling in control of one's own actions influences moral behavior during digital social interactions.

Location: Cafeteria
Poster 80

Am I where I believe my body is?

Giorgia Tosi, Francesca Frisco, Vito Bruno, Daniele Romano

Body illusions can induce illusory embodiment sensations and perceptive spatial displacement of one's body towards fake bodies and avatars. We hypothesised a link between the sense of embodiment and the perception of the body's location in space. To investigate this hypothesis, we administered the Rubber Hand Illusion (RHI) and a Full-Body Illusion-like paradigm (FBI) to 80 participants in virtual reality. We aligned or misaligned their bodies and avatars while registering the Skin Conductance Response (SCR). Before and after each illusion, we measured the embodiment towards the avatar and the perception of the body's location.

Bayesian repeated-measures ANOVAs were employed to evaluate the influence of the illusions on embodiment and proprioceptive drift (the distance between the participant's body and its perceived location). The embodiment best model ($BF_{10}=1.876 \times 10^{45}$) indicated an increased sense of embodiment towards the avatar after the illusions, with weaker sensations in the misaligned FBI condition. We also found an exposure effect before the illusions in the aligned conditions. The SCR was higher during the RHI ($BF_{10}=2.193$). The proprioceptive drift best model ($BF_{10}=1.492 \times 10^{23}$) showed a leftward bias and more accurate estimation in the RHI. The perceived body location shifted towards the misaligned avatar after the illusion, but the correlation with embodiment sensations showed anecdotal evidence favouring the null hypothesis.

Our findings suggest that proprioceptive drift occurs only when a misalignment between the participant's body and the avatar occurs, regardless of the illusion type. However, the body's perceived location does not appear to influence embodiment sensations.

Location: Cafeteria
Poster 81

Gastric correlates of physical and moral disgust: insights from electrogastrography and ingestible sensors

Maria Serena Panasiti, Sofia Ciccarone, Arianna Vecchio, Alessandro Monti, Vanessa Era, Giuseppina Porciello, Salvatore Maria Aglioti

Disgust, originally evolved as a defense against toxins, bacteria, and viruses, is now recognized to extend beyond physical stimuli to encompass moral transgressions, including those perpetrated by the self. While prior studies have explored neural and autonomic correlates of moral and physical disgust, investigations into self-directed disgust remains scarce. Moreover, research concerning the associations between disgust and specific body organs, like the stomach, is sparse. To address these gaps we used electrogastrography (EGG) to gauge indirect gastric activity and inert, ingestible pills to directly assess pH, temperature, and pressure in the gastrointestinal tract. Participants underwent an emotion induction procedure based on narrated stories designed to evoke either physical (e.g., vomit) or moral (e.g., incest) disgust. Perspectives were manipulated to prompt a first-person (self-related) or third-person (other-related) stance. Preliminary findings from a cohort of 24 participants (aged 18-25 years) revealed that first-person physical disgust induced higher EGG frequency compared to moral disgust and neutral induction. Furthermore, moral disgust induced a less acidic pH and a lower stomach temperature than physical disgust, irrespective of perspective assumed. These results suggest that distinct gastric physiological markers may characterize specific types of disgust responses. The association of heightened EGG frequencies with physical disgust, may involve expulsion and avoidance of the contaminating object. Conversely, changes in gastric pH and temperature appear linked to a nuanced emotional experience, possibly driven by an additional evaluation of the moral implications inherent in the content of the induction stimuli.

Location: Cafeteria
Poster 82

I feel as if I were: Investigating the relationship between bodily self boundaries and empathy

Federica Meconi, Andrea Bizzego, Virginia Vanocchi, Laura Crucianelli

Empathy, is the ability to share and understand others' inner states, therefore it is the perception of the other in the self. However, experimental studies have only partially examined the relationship between bodily self-other distinction and empathic abilities. Here, we sought to investigate whether having a good perception of one's own empathy is related to the embodied and psychological experience of one's self. We adopted a series of robust methodologies to test participants' self-body boundaries perception and their empathic abilities.

42 healthy participants underwent a social affective touch task in which we measured the perceived pleasantness of touches applied to participants' forearm and palm using C-tactile afferents-optimal (affective) and non-optimal (emotionally-neutral) velocities. A Rubber Hand Illusion (RHI) was then induced using CT-optimal or non-optimal velocities, known to modulate the strength of the illusion. Lastly, participants completed an adapted version of an empathy task and self-reported measures of state and trait empathy.

Preliminary results show that our tasks were successful in modulating the boundaries of the bodily self and in inducing empathy. A positive correlation was found between state empathy and affective touch sensitivity on the forearm ($r = .284$, $p = .036$), operationalized as the ability to detect differences in pleasantness across affective and non-affective touch. No significant correlations were found between empathy and the outcome measures of the RHI. Thus, empathy seems to relate to the way we perceive social touch on our own skin but not to the malleability of bodily self boundaries.

Location: Cafeteria
Poster 83

In the heart of time: an experimental study on the link between interoception and time perception

Fiorella Del Popolo Cristaldi, Luigi Micillo, Nicola Cellini, Giovanna Mioni

Recent research suggests that our sense of time is directly related to activity in the primary sensory area for interoception. Thus, a better access to body signals, as both objectively measured (i.e., interoceptive accuracy) and subjectively reported (i.e., interoceptive sensibility), may account for a more accurate perception of time. However, evidence on the relationship between interoception and time perception is still inconclusive, and little is known yet about any potential dissociation between implicit and explicit time processing.

In the present study we explored the relationship between interoceptive accuracy and sensibility on one side, and implicit and explicit temporal abilities on the other. We used a heartbeat perception task to measure interoceptive accuracy, and the Porge's Body Perception Questionnaire to measure interoceptive sensibility. We then presented adult subjects (age $M=22.9$, $SD=2.39$) with an implicit (i.e., foreperiod task, $N=28$, 13 M) or explicit (i.e., finger tapping task, $N=23$, 11 M) temporal tasks.

Results showed that higher interoceptive accuracy and sensitivity predict an increased foreperiod effect in the implicit task, indicating that participants were more able to interiorize temporal information to prepare motor response. Regarding the explicit timing task, results showed that higher interoceptive sensitivity predicts lower temporal variability, indicating more accurate and precise temporal abilities. Taken together, our results confirmed that awareness of psychophysiological changes play a role in time perception and interiorization of temporal information to execute motor responses.

*Location: Cafeteria
Poster 84*

Empathy feels in the heart-rate variability

Federica Meconi, Andrea Bizzego, Cecilia Dapor, Samuele Cusin

Empathy is the perception of the other in the self. Studies on the perception of the other's inner states show that we may use the self as a model to understand the other's. However, how the perception of the empathic experience is processed in the bodily self is less understood. The aim of the current study was to investigate how physiological disposition at rest would relate to situational empathy for events participants did or did not experience themselves.

We recorded the cardiac baseline activity from 36 participants, which then performed an empathy task. Participants were exposed to empathy targets described in an event that causes physical pain. For half of the events participants had an associated autobiographical memory. A cover story explained participants that some targets could not perceive pain due to a rare clinical condition of Congenital Insensitivity to Pain (CIPA), whereas other targets were healthy and sensitive to physical pain. Participants expressed how much empathy they felt for each target in each physically painful event on a 1-6 points scale. Results showed higher judgements of empathy for targets sensitive to pain when compared to those with CIPA. Intriguingly, high frequencies, but not low frequencies, of the heart rate variability recorded at rest prior to the empathy task strongly correlated with empathy rates for healthy targets and for autobiographical events but not for targets with CIPA. These results suggest a relationship between the psychological and the bodily self in empathy the closer we perceive the other.

Location: Cafeteria
Poster 85

Dressing the Mind: Shapewear Influences Mind-Body Connection, Altering Body Awareness and Dietary Preferences

Stefania Cionca

Despite the popularity of shapewear, especially among young women, quantitative research examining their effects on our body and behavior is lacking. Clothing type, such as formal or informal attire, can influence food choices (Wang et al., 2021), whereas the sensation of tightness around the stomach in an exposure exercise appears to enhance interoception (Boswell et al., 2019). We hypothesize that wearing tight clothing provides a constant external tactile cue, which triggers cognitive and behavioral adjustments via interoceptive channels. To understand this, in our pre-registered study, we aimed to investigate the effects of wearing tight shapewear on interoception, body image, impulsivity and dietary preference, employing an experimental within-subject design.

Forty-four healthy participants (mean=26.46 years, Std.=5.78, 28 women), with a normal Body Mass Index range of 20-25, were recruited for this study. On each of the two laboratory visits, they wore a tight shapewear or a loose shirt for a duration of four hours, in a counter-balanced design. During this, dietary preference was assessed through a task measuring hedonic ratings of high- and low-calorie foods, as well as willingness to pay. Body image was evaluated using metric body size estimations and a questionnaire. Additionally, interoception was measured with the Heartbeat Discounting Task and a questionnaire, while impulsivity was assessed via the Go/No-Go task.

Our study contributes to the existing body of knowledge on the complex relationship between tactile sensations, interoception, body image, and decision-making in nutrition.

Location: Cafeteria
Poster 86

Impact of attentional bias modification training aiming to reduce the negativity bias on respiration.

Alice Lagacy, Lucas De Zorzi, Mathilde Leroy, Stéphane Ranfaing, Henrique Sequeira

Attentional biases to emotion are present in healthy individuals and interact with autonomically-mediated physiological changes. In this context, attention bias modification training (ABMT) aims to alter attentional deployment to symptom-relevant emotionally salient stimuli. The present double-blind randomized controlled trial explores the effects of a single-session ABMT on physiology.

Healthy participants (n=132) were allocated into trained and control groups. The procedure begins with a baseline period to record physiological parameters at rest. The dot-probe task, using emotional facial expressions, required participants to discriminate two letters. In the training group, the probe consistently appeared behind a joyful facial expression, while the control group faced equal probability with joyful, angry, and neutral expressions. Physiological measurements included respiratory parameters, heart rate variability (HRV), and electrodermal activity (EDA). Trained participants exhibited significant speed and accuracy variations, with a unique reduction in expiration duration post-task.

The results contribute knowledge on the physiological outcomes of attentional modification procedures. They suggest using respiratory parameters as an index for attentional bias modification, with potential applicability to anxious and depressive symptomatology characterized by atypical attentional deployment and autonomic activity.

Location: Cafeteria
Poster 87

The Convergence and Divergence of Interoception and Deception: A Multi-level Kernel Density Meta-Analysis (MKDA)

Lennie Dupont

Interoception, defined as the awareness of internal bodily sensations, plays a critical role in regulating homeostasis, detecting physiological errors, and is intricately connected to emotional processing and moral decision-making. This study used Multi-level Kernel Density Analysis (MKDA) to investigate the neural connection between interoception and deception. Results indicate interoception's involvement in deception through a common brain network, including the bilateral anterior insula (AI), supplementary motor area (SMA), and dorsomedial prefrontal cortex (dmPFC). The study proposes that interoceptive input in the bilateral AI is compared with top-down predictions during deception. Discrepancies might involve higher-order cognitive areas like the dmPFC and SMA to adjust predictions or actions for homeostatic balance.

Additionally, the study found different neural activations depending on the method of interoceptive signal induction. Non-manipulative methods like heartbeat detection involve more of the bilateral posterior insula (PI), middle AI, and Rolandic Operculum (RO), highlighting their role in interoceptive attention and integration. Conversely, manipulative methods like balloon distention show increased involvement of the SMA, MCC, and dmPFC, indicating their role in restoring balance.

This research provides insights into the interplay between interoceptive processes and deception, suggesting potential strategies to address dishonesty in real-world scenarios. It adds valuable knowledge to the understanding of how bodily awareness affects behaviour.

Location: Cafeteria
Poster 88

The Cognitive Consequences of Training the Body in the Process of Drawing a Perfectly Straight Line Free-Hand

Karunya Srinivasan, Salvador Soto Faraco

Research on human development, gesture production and understanding, and embodied cognition suggest that cognitive processes cannot be separated from the body or its environment. The present proof-of-concept study examines this interconnection using the Geography of Corporal Consciousness (GEOCOCO) method. We addressed the cognitive consequences of learning to execute a particular motor act (drawing a straight line free-hand), when this learning requires precise awareness of the body and its movement in relation to its surroundings. The line in GEOCOCO is a trace of the body's movement. The precision of this line is a reflection of the precision of the coordination of the full body to carry it out – an act involving e.g., attention to at least 20 inputs, fine and gross motor skills, motor pattern sequencing, and awareness of the body's position in space. We measured the effect of receiving a GEOCOCO training on performance on four cognitive tests in the domains of executive control, proprioception, visuospatial orientation, and visuospatial memory, using a pre-test – post-test design. The experimental group, receiving 5-week GEOCOCO training, was compared to an active control group receiving geometric drawing training, and a passive control group. Results from 22 participants indicated significant improvement in executive control and some aspects of proprioception in the GEOCOCO group. While other test outcomes lacked statistical significance, these findings suggest potential cognitive benefits associated with the GEOCOCO Method, advocating for deeper, extensive research into its cognitive implications and more broadly, the relevance of studying motor training in the context of cognition.

Location: Cafeteria
Poster 89

Walking with My Heart: Investigating the Effect of Real-Time Sensory Feedback of Bodily Movements and Heartbeats on Embodiment in Depersonalisation

Simon Knogler

Synchronizing exteroceptive signals, manifested through bodily movements, with interoceptive processes like breathing—a method often utilized in yoga practices—has been shown to enhance an individual's sense of presence and embodiment (Park & Blanke, 2019; Courtois, 2004; Piran & Neumark-Sztainer, 2020). Drawing inspiration from this principle, our study explores a novel paradigm: the synchronization of locomotion with heartbeats. We will investigate whether synchronizing the rhythmic, voluntary act of walking with the involuntary rhythm of the heartbeat can enhance feelings of embodiment and presence. In particular, our study aims to explore the potential of such dynamic embodiment interventions in Depersonalisation, a condition characterized by a detachment from one's self and body (Sierra & Berrios 1998; Ciaunica et al., 2021; Perkins, 2021).

To this end, we will recruit 80 participants, divided into two groups based on the frequency of their Depersonalisation experiences. Our experimental approach integrates the 'Magic Shoes' apparatus (Tajadura-Jiménez et al., 2015), designed to augment exteroceptive feedback from footsteps, with a portable cardiac monitor. Participants will be instructed to synchronize their gait to auditory cues that are either aligned (200ms after each R wave of the cardiac cycle) or misaligned (t drawn from a random distribution) with their cardiac rhythm. Additionally, one walking condition will incorporate augmented auditory feedback derived from the participants' footsteps. Following each walking trial, participants will be engaged in a Graphesthesia task (Arnold et al., 2017) - an implicit measure of embodiment. Consecutively, participants will be administered the Cambridge Depersonalisation Scale (CDS-State) questionnaire to evaluate their depersonalization experiences.

Location: Cafeteria
Poster 90

Role of vision in the plasticity of body schema and peripersonal space induced by tool-use in healthy aging

Amir Jahanian Najafabadi, Sarvenaz Changizi, Rozhan Rashidi, Sadegh Shahriar, Hadis Imani

Prior research by Sun and Tang (2021) reported increased perception of the size of the forearm of the hand using the tool while perception of other body parts did not change. Their results demonstrated that the proprioception information of one limb could be exploited by another limb to extend the body schema even though that limb was not using a tool. In this research, we replicated their study with similar conditions and expanded further to understand to what extent body schema is plastic under the presence or lack of visual modality and depending on the age of the participants, and whether the effect is comparable. In total, forty young and older right handed individuals participated (each group had 20 individuals, aged 18-30 and 60-75 years, respectively). Tactile distance judgment task and a reaching distance estimation task were used to investigate changes in the body schema of four target body parts (the dorsal surface of the right hand, right forearm, right calf, and right foot) as well as peripersonal space. Participants underwent three conditions of tool-use training; (1) walking blindfolded with a cane for 20 minutes; (2) walking with a cane to find the target object; (3) walking blindfolded without a cane for 20 minutes. Results of this study call into question to what degree and how robustly body schema is plastic by the role of vision and how malleable this is by extension of the peripersonal space representation toward the acting space by tool-use training in healthy aging.

Location: Cafeteria
Poster 91

Theta activity discriminates high-level, species-specific body processes

Jane Chesley

Among social stimuli that trigger rapid reactions, body images occupy a prominent place. Given that bodies carry information about other agents' intentions, actions and emotional expressions, a foundational question concerns the neural basis of body processing. Previous fMRI studies have investigated this but were not yet able to clarify the time course and its functional significance. The present EEG study investigated the role of slow oscillatory cortical activity in body processing and species-specificity. Human participants viewed naturalistic images of human and monkey bodies, faces, and objects, along with mosaic-scrambled versions to control for low-level visual features. Analysis of event-related theta power (4 – 7 Hz) combined with data-driven methods revealed a strong, body-evoked neural response that is specific to human bodies and likely originates from a widespread scalp region during a time window of 150 – 550 ms after the onset of the body image. Our results corroborate recent research proposing a widespread, species-specific cortical network of human body processing. We submit that this network may play an essential role in linking body processes to movement intentions.

Location: Cafeteria

Poster 92

The role of affective touch in promoting autonomic self-regulation in preschool-age children

Letizia Della Longa

Affective touch, mediated by activation of C-tactile afferents, has been shown to foster autonomic self-regulation and modulate affective states in situations of distress in early infancy (Feldman et al., 2010) and across the lifespan (Fotopolou et al., 2022). The present study aims to investigate whether affective touch modulates heart rate variability (HRV), which is considered an index of vagal activity associated with autonomic regulation, in preschool-age children after watching neutral and emotional cartoons. Participants (N=68, age range 3-6 years) were presented with a neutral video (first block) and a scene of child crying (second block - emotional condition). Each video lasted 2min and was followed by 2min of touch, either affective (slow stroking with a brush) or non-affective (gentle tapping with the brush handle) as between-subject condition. Moreover, parents filled the Children's Behavioural Questionnaire (Rothbart, 2001) to assess children's temperament. Results revealed a larger increase of HRV during tactile stimulation in children perceiving affective touch compared to children exposed to non-affective touch, in both experimental blocks, suggesting the specific role of affective touch in enhancing vagal activity. Temperamental traits modulated such effect. Specifically, children with lower scores of effortful control, meaning the ability to manage attention, inhibit or activate behaviours as needed to adapt, showed more sensitivity to affective touch. In conclusion, affective touch has been shown to increase HRV in both neutral and emotionally salient conditions, possibly supporting autonomic self-regulation. Importantly, our results indicate that affective sensory stimulation may be particularly beneficial for children with vulnerability in behavioural self-regulation.

Location: Cafeteria
Poster 93

In the family heartbeat: exploring how socio-affective scenarios modulate maternal, paternal, and infant cardiac responses

Greta Chiodi, Elena Guida, Chiara Turati

Early family interactions strongly predict infants' socio-affective development (Favez et al., 2017). Most studies on how interpersonal context modulates physiological responses focus on parent-infant dyads (Rattaz et al., 2023). However, child's social context also includes triadic interactions with both parents (FivazDepeursinge & Corboz-Warnery, 1999). To date, no study has explored how triadic versus dyadic interactions impact physiological arousal regulation at the family level. Using an observational paradigm (Lausanne Trilogue Play), we examined how the family context modulates Heart Rate (HR) responses in a cohort of 4-month-old infants and their parents. HR serves as a reliable indicator of cardiac events associated with environmental changes.

Results show that the different interactive contexts modulate the cardiac activation. The child displays higher arousal activation (bpm) in the triadic exchange vs. dyadic exchange ($F(1, 3) = 135.47$; $p < .01$). Conversely, both mothers ($F(1, 3) = 689$; $p < .01$) and fathers ($F(1, 3) = 577.56$; $p < .01$) reduce physiological activation during triadic interactions compared to dyadic interactions. Thus, during the parental interaction the child's heart rate further increases while parents' heart activation decreases. The observed pattern suggests that infants may need heightened socio-affective and cognitive resources during triadic interactions due to increased stimulation; during parental exchanges, lacking external regulation could pose challenges for infants dealing with potential social exclusion. Notably, partner support appears to reduce physiological activation in parents. These findings underscore that early triadic interactions distinctly shape physiological arousal responses in infants, mothers, and fathers compared to dyadic interactions.

Location: Cafeteria

Poster 94

Can ostracism modulate infants' behavioural reactivity and neural processing of emotional faces?

Giada Basset, Ermanno Quadrelli, Julia Mermier, Hermann Sergio Bulf, Chiara Turati

Processing others' emotional facial expressions is an ability that appears at early stages of development (Rayson et al., 2017) and is fundamental for social communication (Kobiella et al., 2008). Several studies have investigated the neural correlates of face processing in infancy (Kobiella et al., 2008; Quadrelli et al., 2019; 2021), but little is known about whether and how this processing can be affected by self-experienced ostracism during infancy. This study aims to explore whether being included or ostracized during a triadic ball-tossing game can influence 13- to 14-month-old infants' behavioral and emotional reactivity during the game and the subsequent neural processing of emotional faces. We implemented a live triadic ball-tossing game (Quadrelli et al., 2023) in which infants participated, being either included or ostracized while playing with two experimenters. Following the ball-tossing game, event-related potentials (ERPs) were measured while infants observed faces displaying dynamic expressions of fear and happiness. Results on behavioral and emotional reactivity during the ball-tossing game revealed that ostracism influenced infants' negative emotionality and involvement behaviors, while results on ERPs revealed a faster P1 to happy faces in the ostracism vs. inclusion condition and, in the inclusion condition, fearful faces elicited faster responses than happy expressions. Current results indicate that ostracism affects infants' behavior and alters the neural processing of emotional faces, implying potential negative cascading effects on their affective and cognitive development. These findings underscore the importance of understanding the early impact of social experiences on infant development.

Location: Cafeteria

Poster 95

Ostracism affects school-aged children's and adults' behavioral reactivity and gaze cueing of attention.

Giada Basset, Alessia Testa, Ermanno Quadrelli, Chiara Turati, Hermann Bulf

Being ostracized is a negative experience that threatens important psychological needs, inducing considerable cognitive and behavioral changes (Kawamoto et al., 2014; Quadrelli et al., 2023). Literature demonstrated that ostracism influences the processing of social stimuli in adults (Bossi et al., 2018, Capellini et al., 2019), but little is known about how self-experienced ostracism influences children's behavior and about the impact of ostracism on children's processing of social signals (Mermier et al., 2023). The aim of the present study was to explore whether being included or ostracized in an online ball-tossing game (Cyberball, Williams et al., 2000) can influence the processing of gaze direction in 6- and 10-year-old children and adults and their behavioral reactivity during the game. Participants played a Cyberball game being either included or ostracized and subsequently participated in a gaze cueing task, where the cue was given by eye-gaze of a central human face and the target could appear in a congruent or incongruent position. Behavioral reactivity results demonstrate that both children and adults were more disappointed during the ostracism vs. inclusion condition, and that adults smiled more during the ostracism condition while 10-year-olds smiled more when included. Results from the gaze cueing task revealed that ostracism affected adults' and children's gaze cueing, since they were slower to respond to incongruent targets when ostracized as compared to when included. Additionally, ostracism also impaired 10-year-old children's accuracy in responding to the target. Overall, current findings demonstrate that self-experienced ostracism can impact children's and adults' behavior and social signals processing.

Location: Cafeteria
Poster 96

Unveiling the hidden rhythms: Aperiodic analysis of EEG activity in healthy subjects during development

Carlos M. Gómez, Brenda Y. Angulo Ruiz, Elena I. Rodríguez Martínez, Vanesa Muñoz

The present study analyzes the power spectral density (PSD) and its components, aperiodic (AP) and periodic (P) activity, in the electroencephalogram (EEG) during resting state condition (open-eyes). 240 healthy subjects from 6 to 29 years old, divided into 4 groups (6-9; 10-13; 14-17; 18-29) were analyzed. We calculate aperiodic and periodic components of the PSD using the Fitting Oscillations and One-Over-f (FOOOF) function in EEGLAB. All components of the PSD (PSDadjusted, AP and P) were calculated from 1 to 45 Hz. Topography analysis, Spearman correlations and regression analysis (with age in days) were performed for all the calculated components. The results show different topography between aperiodic and periodic activity across a wide range of frequencies and age groups, along with a decrease with age in the AP component; and decreases (1-6 Hz) and increases (10-15 Hz) in the P component. Thus, we support the distinction between the aperiodic and periodic components of the PSD and its possible functional changes with age.

Location: Cafeteria
Poster 97

Does olfactory kin recognition persist into the teenage years?

Katharina Hierl, Laura Schäfer

a. Kin Recognition is a crucial evolutionary mechanism that promotes prosocial behavior towards kin, reduces incest, and is mediated by body odor. Behavioral studies have shown that olfactory kin recognition is associated with relationship quality between mother and child, and emotional attachment. As the demands on parental care and bonding change with increasing age of the child, chemosensory signals and their perceptual correlates may also shift. However, to date, studies concentrating on olfactory kin recognition and perception in adolescents remain rare and conflicting in their results.

b. We therefore aimed to investigate kin recognition performance and odor perception in biological families, consisting of mother, father and two same-sex adolescent children (to eliminate possible effects of opposite-sex odor perception).

Inclusion criteria were homogenous pubertal status of the children, according to a standardized scale, one shared household for all family members, to control of odor exposure, and normosmia. We target a sample size of $N = 64$ (16 families).

Using a standardized protocol, underarm odors of all family members were collected. Later, these samples were rated on perceptual scales of pleasantness, intensity and wanting. In addition, the subjects were asked to identify their family members in a 3 alternative forced choice task.

c. Due to ongoing data acquisition, we cannot yet make statements about the results of our study and possible conclusions. We intend to complete data collection by February 2024 so that we can finalize the presentation with our findings.

Location: Cafeteria
Poster 98

Potential neurostructural predictors of binge drinking/alcohol use in emerging adulthood: a 5-year follow-up study

Samuel Suárez-Suárez, Sonia Doallo, Jose Manuel Pérez-García, María Soledad Rodríguez González, Socorro Rodriguez Holguin, Fernando Cadaveira

Binge drinking (BD) is characterized by the intake of high amounts of alcohol in one single occasion, resulting in a blood alcohol concentration (BAC) of 0.08 g/dL or higher. This is a prevalent pattern of alcohol consumption among young adults, which has attracted a great deal of attention from researchers because of its potential impact on the brain and subsequent drinking behaviors. This study employed a hierarchical multiple linear regression model to examine whether different neurostructural metrics (i.e. volume, surface area, cortical thickness) of brain regions involved in executive and emotional/motivational processes at the age of 18-19 (baseline; N = 77) were significant predictors of alcohol use 5 years later, when they complete their university stage. Results showed that after controlling baseline consumption and sex, surface area in the rostral division of the right middle frontal gyrus significantly predict total drinks in the past six months ($\Delta R^2 = 0.039$, $\beta = 0.299$), drinks per drinking occasion ($\Delta R^2 = 0.089$, $\beta = 0.440$), maximum drinks per day ($\Delta R^2 = 0.053$, $\beta = 0.361$) and BD episodes in the past six months ($\Delta R^2 = 0.048$, $\beta = 0.315$). These findings suggest neurostructural anomalies in executive-related brain regions critically involved in regulating activity in subcortical areas linked to affective and motivational processes (i.e. amygdala, nucleus accumbens) and which could make adolescents under development prone to involve in risky behaviors, such as alcohol use.

Location: Cafeteria
Poster 99

Impact of negative affect on decision making: exploring emotion-cognition interplay in young binge drinkers

Samuel Suárez-Suárez, Carina Carbia, Damien Brevers, Pierre Maurage

Intense emotional states, notably following stress induction, can bias lower (e.g., perception, attention) and higher level (e.g., inhibition, decision-making) cognitive abilities. Such emotion-cognition interactions are particularly relevant during emerging adulthood, a period marked by both high stress and still-developing emotion regulation abilities. Adolescence and early adulthood are moreover associated with high prevalence of binge drinking (BD), an alcohol consumption pattern characterized by the alternance between excessive alcohol intakes and abstinence periods. BD is linked with anomalies both in emotional processing and decision-making, but these two categories of impairments have, up to now, been explored separately.

We explored the specific impact of BD on the interactions between emotional and cognitive abilities by measuring the impact of autobiographical negative mood induction procedure on decision-making. Seventy-five university students (age range, 18-25 years old) with BD habits (n=43) and low drinking level (n=32) underwent a negative mood induction procedure before performing the Iowa Gambling Task (IGT) in a neuroimaging paradigm. Behavioral performance and brain activity (fMRI) will be presented to characterize the potential impact of current mood on affective decision-making. We expect binge-drinkers to present poorer decision-making abilities compared to controls, particularly after mood induction, as they might present greater difficulties in regulating their emotions. We also expect to observe an imbalance in the brain activity of key brain regions for emotion- and decision-making-related areas. Our results will offer insights into the interactions between emotional and cognitive processes in subclinical alcohol-related disorders, opening new research perspectives to go beyond the currently compartmentalized research fields.

*Location: Cafeteria
Poster 100*

Subtle Microstructural Alterations in White Matter Tracts Involved in Socio-emotional Processing After Preterm Birth

Ward Deferm, Tiffany Tang, Matthijs Moerkerke, Nicky Daniels, Jean Steyaert, Kaat Alaerts, Els Ortibus, Gunnar Naulaers, Ward Deferm

Preterm-born children have an increased risk of developing socio-emotional difficulties. A possible neural substrate for these socio-emotional difficulties may be alterations in structural connectivity of the social brain due to premature birth. The objective of the current study was to study microstructural alterations in white matter tracts related to socio-emotional processing (i.e., IFOF, SLF I, SLF II, SLF III, UF, ILF) after preterm birth.

We obtained diffusion MRI scans of 35 preterm and 38 full term born 8-12 years old children. Tractography was performed using TractSeg, a state-of-the-art convolutional neural network-based approach. Group differences in FA along the tracts were investigated using both a traditional and complementary functional data analysis approach. Exploratory correlations were performed between the Social Responsiveness Scale (SRS-2), a parent-report questionnaire assessing difficulties in social functioning and FA along the tract

No significant group differences in FA were found along the bilateral IFOF, ILF, SLF I, UF, left SLF I, and right SLF I. However, we found a decrease in FA for the preterm group in a middle portion of the right SLF I and an anterior portion of the left SLF II. These group differences may reflect altered white matter maturation due to premature birth and may contribute to altered connectivity in the Theory of Mind network. In the preterm group, FA in portions of the right IFOF, SLF II and left SLF I was significantly correlated with total scores on the SRS-2, indicating a relation between white matter microstructure along these tracts and social functioning.

*Location: Cafeteria
Poster 101*

Systematic review of the neural correlates of joint attention in infants aged 8-24 months

Vera Mateus, Ana Carolina Santos, Ana Ganho Ávila, Mónica Sobral, Ana Osório, Sara Cruz

Joint attention (JA) refers to the infant's ability to coordinate their attention with a social partner towards an object (e.g., a toy). JA abilities typically emerge around 9 months of age and become more frequent in infant behavioural repertoire during the second year of life. Previous studies have highlighted the involvement of several networks of the social brain in the processing of joint attention stimuli. The aim of the present work was to systematically review the literature on the neural correlates of JA in infants between 8 and 24 months of age, when these abilities emerge and become more frequent on their behavioural repertoire. We conducted a literature search in PubMed, Web of Science, PsycINFO and Scopus databases for empirical studies published in English from inception to February 2023, and updated in December 2023. Fifteen studies were included, of which ten studies used electroencephalography, three used functional near-infrared spectroscopy, and two studies used functional magnetic resonance imaging to assess infants' brain activation. The data suggest a pattern of cortical activity involving frontal, central and parietal regions of infants' brain in response to JA stimuli, including, for example, the prefrontal cortex, superior temporal cortex, and the temporoparietal junction. The findings contribute to identify specific neural signatures that may be useful for the early detection of neurodevelopmental disorders.

*Location: Cafeteria
Poster 102*

Stress and cardiac-cycle-time effects on the processing of stimulus-stimulus vs. stimulus-response conflicts.

Leon von Haugwitz, Edmund Wascher, Mauro Larrá

Variations in cardioafferent traffic are relayed to the brain via arterial baroreceptors and have been shown to modulate sensorimotor and cognitive processes. Stress potentially influences these effects via both humoral and neuronal pathways by altering cardiovascular activity and modulating areas of the central nervous system. We investigated how cardiac-cycle-time and stress modulate sensorimotor and cognitive processes by contrasting effects in a Simon Task (stimulus-response conflict) and a spatial Stroop Task (stimulus-stimulus conflict). In each of two sessions, 30 participants performed three blocks where stimulus presentation was aligned to the cardiac cycle, targeting systolic versus diastolic phases i.e., high versus low cardioafferent activity. Depending on the session, subjects were exposed to the cold-pressor-test (CPT) or to a warm water control condition before each block. Response times, errors, and electroencephalography were assessed. The CPT increased saliva cortisol, cardiovascular measures, and subjective ratings of stress. We found the expected compatibility effects in the conflict tasks i.e., incompatible compared to compatible trials showed increases in response time, latency of the lateralized readiness potential (LRP), as well as frontocentral N2 amplitude. Under stress, responses in the Simon task were slowed during systole compared to diastole. Furthermore, frontocentral N2 amplitude was significantly reduced by stress in incompatible Simon trials. Moreover, N2 amplitude was also decreased during systole compared to diastole in Stroop trials. These results indicate an inhibitory effect of cardioafferent traffic on electrophysiological correlates of conflict detection specifically in stimulus-stimulus conflicts. Furthermore, our results demonstrate that stress modulates cardiac cycle effects on the brain.

*Location: Cafeteria
Poster 103*

Continuous Monitoring of Psychosocial Stress by Non-Invasive Volatilomics

Elias Mansour, Walaa Saliba, Yoav Broza, Ora Frankfurt, Liat Zuri, Karen Ginat, Eilam Palzur, Alon Shamir, Hossam Haick

Stress is becoming increasingly commonplace in modern times, making it important to have accurate and effective detection methods. Detection methods such as self-evaluation and clinical questionnaires are subjective and unsuitable for long-term monitoring. There have been significant studies into biomarkers such as Heart Rate Variability (HRV), cortisol, electrocardiography, and blood biomarkers, but the use of multiple electrodes for electrocardiography or blood tests are impractical for real-time stress monitoring. To this end, there is a need for non-invasive sensors to monitor stress in real-time. This study looks at the possibility of using breath and skin Volatile Organic Compounds (VOCs) fingerprinting as stress biomarkers. The Trier Social Stress Test was used to induce acute stress and HRV, cortisol and anxiety levels were measured before, during and after the test. Gas Chromatography – Mass Spectrometry and sensors array were used to collect and measure VOCs. A prediction model found eight different stress-related VOCs with an accuracy of up to 78%, and sensors revealed a significant difference in breath VOCs fingerprint between the two groups. These stress-related VOCs either changed or returned to baseline after the stress induction suggesting different metabolic pathways at different times. A correlation analysis revealed an association between VOCs and cortisol levels, and a weak correlation with either HRV or anxiety levels, suggesting that VOCs may include complementary information. This study shows the potential of VOCs as stress biomarkers, paving the way into developing a real-time, objective, non-invasive stress detection tool for wellbeing and early detection of stress-related diseases.

Location: Cafeteria
Poster 104

Modeling and predicting stress resilience in real life: preliminary results from cross-sectional analysis.

Alessio Proposito

Stress-related disorders represent severe mental illnesses that constitute a heavy burden for the individual and society. The ongoing transition in clinical strategy from treatment towards prevention and health maintenance has increased the focus on understanding and enhancing stress resilience. Prior research focused on identifying subjective measures that predict resilience following stress exposure (resilience factors). However, predictors from objective measures and real-life resilience markers are lacking. Additionally, most studies have been conducted on non-representative samples. We aim to reduce this gap using the dataset of the Healthy Brain Study (HBS; <https://www.healthybrainstudy.nl>). This large cohort study tracked for one year over 700 individuals from diverse backgrounds, conducting extensive assessments in both laboratory and real-life environments. In this project, we aim to 1. validate a measure of resilience using the HBS data, 2. replicate and extend earlier works on resilience factors. Building on recent theories, we conceptualize resilience as the maintenance of mental health despite exposure to stressors. We operationalize it using normative modeling as the inverse residual of stress-related mental health symptoms regressed onto stress exposure. We aim to test the association between resilience and resilience factors using 1. self-reported trait measures, 2. cognitive regulation of emotion, operationalized with startle EMG in an emotion regulation task, and 3. affective reactivity to real-life acute stressors using ecological momentary assessment. The analysis of the data is ongoing, I will present preliminary results on cross-sectional resilience factors, and discuss how we can, based on these findings, investigate dynamic changes in resilience following stress exposure.

*Location: Cafeteria
Poster 105*

In search for the neural signature of stress: Isolating stress from somatosensory processing in the EEG

Mauro Larrá, Leon von Haugwitz, Edmund Wascher

Stress originates in the brain but is typically measured via peripheral physiological reactions. EEG offers the possibility to quantify neocortical processing during exposure to laboratory stressors which may facilitate our understanding of how the brain regulates stress. However, disentangling procedural from stress-specific EEG effects poses a major challenge. The widely used Cold pressor test (CPT), for instance, is characterized by a strong somatosensory component that may dominate EEG recordings and thus obscure the central-nervous processes of interest. Here, we leveraged the lateral specificity of somatosensory projections by repeatedly exposing 60 participants to unilateral left vs. right feet CPTs as well as the respective warm water control procedures, according to a within-subjects design. Each exposure was conducted under both eyes-open and eyes-closed conditions and lasted 3 minutes during which EEG was derived from electrodes contra- and ipsilateral to the respective side of stimulation. Cortisol, cardiovascular and subjective reactions were measured to quantify stress responses. The CPT induced substantial stress reactions across measures. Compared to control, increases in frontal delta-theta power could be observed during stress. These were correlated to cortisol reactions and occurred lateralized but were unrelated to side of stimulation. Our results corroborate earlier findings of frontal delta power increases during stress and suggest that these are indeed reflective of central-nervous stress regulation.

Location: Cafeteria
Poster 106

Resilience under stress: Investigating the neurobiological correlates of emotional conflict and arousal in a preregistered prospective cohort study

E. Mcpherson, L.E. Meine, M. Grueschow, C.C. Ruff, B. Kleim

Introduction

The locus coeruleus-norepinephrine (LC-NE) system is important in emotion and arousal regulation and is implicated in the development of stress-related disorders, such as depression and anxiety. To investigate responses to acute and chronic stress, medical students completed an arousal paradigm during fMRI and were followed during their first medical internship.

Methods

Prospective medical interns (N=102, 73% female, 18-35 years old) participated in a modified emotional conflict adaptation task involving fearful/happy faces overlaid with the words “happy”/“fear” under a threat-of-shock arousal paradigm. Data were acquired prior to a stressful medical internship expected to lead to varying degrees of stress-related psychopathology. This preliminary analysis will investigate contrasts and sequence effects of congruent (happy-happy/fear-fear) and incongruent (happy-fear) trials in behavioural and LC BOLD responses.

Results

As expected, we report longer reaction times and poorer accuracy for incongruent trials compared to congruent trials. We also examine the LC BOLD response to trial sequence effects by contrasting activity during incongruent trials preceded by congruent trials with that to congruent trials preceded by congruent trials. Finally, we investigate the effect of acute stress induction by comparing LC BOLD responses under threat of mild, versus strong, shock.

Conclusion

Further work will relate indices investigated here to longer-term mental health during the medical internship to identify markers of stress resilience. Our analyses aim to establish neurobiological correlates of emotion regulation in the context of stress resilience, with implications for the development of interventions for vulnerable individuals.

Location: Cafeteria
Poster 107

**“Empathic Immunity” – How we feel about others may contribute to how well we feel.
Behavioral and biological preliminary results.**

Moran Knafo, Simone Shamay-Tsoory

Empathy is a multi-component process involving at least two components: an emotional component referred to as state-matching or affective sharing, and a more cognitive component called perspective-taking (Shamay-Tsoory, 2011). Here we examine whether the immune system plays a role in empathy. We coin the term ‘empathic immunity’ representing the inclination to adjust one's immune reaction in response to another individual's state and can be conceptualized as a feedback-loop involving an infected target and an observer. To test this hypothesis, we exposed participants (N=60) to short films of targets diagnosed with flu or covid 19, describing their symptoms and to control films. In addition, participants provided one saliva sample before watching the videos (T0) and two after (following exposure to the films (T1) and 30 minutes following exposure (T2)), to assess the activation of the immune system through the measurement of proteins called cytokine. The results indicated that, compared to control films, exposure to films featuring infected individuals led to increased ratings of empathic concern and personal distress scales. Observing the films was also associated with increased reports of symptoms (mostly muscle aches, sore throat and phlegm), indicating that participants may internally imitate the observed symptoms. Importantly, preliminary results (N=7) indicated a significant increase in IL-1 β (P=0.039) and changes in IL-6 were marginally significant (P=0.068). Although the sample is small, it represents initial evidence that observing sickness triggers empathy and is associated with changes in cytokines levels.



May 24th – 2:00pm – 3:30pm

ORAL TALKS

Location: Auditorium 2

Oral talks 7: Stress & Anxiety

The role of brain-spinal cord networks in defensive responses to threat

Elena Andres, Lucia Mihaliková, David Norris, José Marques, Linda de Voogd, Karin Roelofs

The spinal cord (SP) serves as a crucial pathway for all communication between the body and the brain. Descending circuits from the brain connect to the muscles through the ventral horn (vSP). Conversely, ascending circuits link the periphery to the brain, transmitting sensory information through the dorsal horn (dSP). The fine-tuning of sensory and motor functions via the SP becomes particularly important during threat responses, especially in attentive freezing (Roelofs, 2017; Roelofs & Dayan, 2022).

Freezing, characterized by immobility and bradycardia, is an attentive state allowing individuals to assess the situation and plan potential actions. While it is associated with parasympathetic dominance, concurrent sympathetic arousal is linked to an increase of muscle tone and action preparation.

Our goal is to gain a comprehensive understanding of brain-SP connectivity under acute threat, with a specific focus on threat-induced bradycardia. Using fMRI, we simultaneously measure brain and SP activity to replicate previous findings of brain-SP connectivity patterns during rest (Vahdat et al., 2020) and explore whether these patterns change under acute threat. Additionally, we are investigating whether individual physiological responses, such as heart rate reduction during anticipatory freezing at conditioning and extinction, are related to changes in brain-SP connectivity.

The data collection for a subject sample of N=55 has been successfully concluded, and preliminary analyses indicate distinctive patterns for dorsal versus ventral SP – brain connectivity.

Our current study lays the groundwork for future research exploring sensory processing, motor preparation, and decision-making under threat in a comprehensive integrated manner.

Location: Auditorium 2
Oral talks 7: Stress & Anxiety

The bodily-emotional experience of time: temporal interval perception is modulated by anxiety

Gaia Lapomarda, Carmen Morawetz, Alessandro Grecucci, David Melcher

Time perception is crucial in our life, and emotions can powerfully modulate it. The ability to interpret bodily changes (interoception) influences individuals' emotional experiences, and the insula plays a key role in this process. However, the neural representation of the relationship between time, emotions, and body remains unclear.

Here, we investigated the effect of anxiety on time perception, considering variations in interoception. We hypothesized that better interoceptive abilities would predict more intense emotions, which would disrupt time perception. This would be mirrored in a modulatory effect of the amygdala on the integrative function of the insula.

To test this, participants (N=30, 15 females, mean age=21.75±4.28) performed an auditory temporal reproduction task while undergoing fMRI. In half of the blocks, they were at risk of hearing random screams (threat condition), whereas in the other half, they were ensured that no screams would be presented. In addition, their interoceptive accuracy was assessed outside the scanner.

Our paradigm successfully induced emotional changes, with higher anxiety perceived in the threat blocks (SE=1.62, $t=6.13$, $p<.001$). Increased interoceptive accuracy was related to increased experience of anxiety (SE=0.55, $t=4.82$, $p<.001$). Higher anxiety predicted greater underestimation of long durations (Accuracy Reproduction: SE=0.01, $t=-3.98$, $p<.001$). To determine the interaction effect of emotions and temporal experience at a neural level, we looked at the functional interplay between amygdala and insula.

These first results suggest a disruptive effect of anxiety on temporal perception. Exploring the neural underpinning of this process can inform how the brain-body interaction modulates affective and cognitive processes.

Location: Auditorium 2

Oral talks 7: Stress & Anxiety

Exposure to virtual nature decreases neural nociceptive processing and self-reported ratings during acute pain

Maximilian Steininger, Mathew P. White, Lukas Lengersdorff, Lei Zhang, Alexander J. Smalley, Simone Kühn, Claus Lamm

Engaging with nature provides numerous physical and mental health benefits, including reductions in self-reported pain. However, it remains unclear whether these reduced subjective ratings reflect modulations specific to pain, such as changes in low-level nociceptive or high-level cognitive-emotional processing or can be explained by domain-general factors unspecific to pain. To answer this question, we conducted a preregistered functional MRI experiment during which healthy participants (N = 49) received individually calibrated painful electrical shocks while exposed to audio-visual virtual nature, urban, and indoor environments. Replicating previous findings, exposure to virtual nature (vs. urban or indoor settings) was associated with lower self-reported pain. Using multivoxel machine-learning derived brain patterns, we found that this decrease aligned with reduced low-level nociceptive but not high-level cognitive-emotional pain processing. Furthermore, exposure to virtual nature was characterised by diminished activity in single brain regions associated with nociceptive processing, such as the secondary somatosensory cortex, posterior insula, thalamus, and amygdala. Notably, all effects were specific to nature and not observed in the other two environments. Lastly, exploratory (non-pre-registered) connectivity analyses revealed modulations in functional coupling of the periaqueductal grey and anterior insula with prefrontal and parietal regions when comparing virtual nature and urban environments. These findings suggest that nature exposure may reduce pain predominantly by acting on nociceptive processes. Our study highlights that even brief exposure to audio-visual virtual nature can reduce pain and provides a mechanistic explanation for how such exposure can be used in a simple and cost-effective way in various contexts.

Location: Auditorium 2

Oral talks 7: Stress & Anxiety

Identifying direct subcortical pathways of the amygdala within the human auditory system using diffusion weighted imaging tractography

Emmanouela Kosteletou Kassotaki

Quick and efficient detection of threat is critical for survival. To serve this ability, a visual subcortical pathway, is believed to function in humans as a shortcut to the amygdala (a key structure for threat detection), with direct neural projections from the retina, superior colliculus and the pulvinar of the thalamus. Similarly, evidence from non-human animals suggest the existence of a homologous subcortical pathway in audition, but this pathway remains unknown in humans. To address this question, we applied probabilistic streamline tractography and Fixel Based Analysis to diffusion-weighted images obtained from the Human Connectome Project, reconstructed candidate auditory subcortical pathways and correlated their metrics with behavioral data available. Similarly, we examined the existence of an additional subcortical output pathway from the amygdala to the inferior colliculus, previously only described in bats. Our findings suggest the existence of white matter tracks directly projecting to the amygdala from the medial geniculate body of the thalamus and the auditory and audiovisual portions of the pulvinar (i.e. anterior and medial) showing left-right asymmetries. Interestingly, individuals with greater fiber density and number of streamlines in these pathways show a better hearing ability in noise and stronger feelings of fear and anxiety, respectively. These results point to the existence of a human auditory pathway for fast threat detection that may be homologous to that in the visual system. Finally, our evidence suggests the existence of a subcortical pathway connecting the amygdala with the inferior colliculus in humans, which may impose emotional content into sensory stimulus processing.

Location: Auditorium 2

Oral talks 7: Stress & Anxiety

Moral inference under stress

Stefan Schulreich

Adaptively navigating an uncertain social world often requires individuals to infer other people's moral character based on their observed behavior. Recently, this inferential process has been elucidated through the lens of Bayesian learning, wherein beliefs about others' character are dynamically updated in proportion to the uncertainty of those beliefs. This theoretical framework suggests that stress, a psychophysiological state intricately tied to uncertainty, may influence moral inference. Specifically, we hypothesized that acute stress would increase belief uncertainty and, consequently, volatility. To investigate this link, participants were randomly assigned to either a psychosocial stress or control condition, before engaging in predicting and observing moral decisions of two distinct agents with differing moral characters. Consistent with prior research, Bayesian computational modeling revealed that beliefs concerning the morality of a perceived "bad" agent were more uncertain and therefore more volatile compared to beliefs about "good" agents. Remarkably, our findings show that acute stress increased belief uncertainty and volatility for good agents, provided the good agent was observed first (i.e., temporally closer to the stressor). Furthermore, this effect was found to be associated with elevated salivary cortisol levels, suggesting a potential mediation through glucocorticoid action. Our study sheds light on the intricate interplay between acute stress and moral inference. The observed increase in belief uncertainty and volatility for putatively good agents may reflect an adaptive mechanism in an uncertain environment. These insights contribute to our understanding of the nuanced ways in which stress can shape social cognition and moral judgments.

Location: Auditorium 4

Oral talks 8: Agency, Body, and Touch

The readout of bodily cues to predict social interaction

Edoardo Arcuri, Martina Ardizzi, Vittorio Gallese

Motor coordination in social interactions necessitates the swift interpretation of others' actions, yet the pivotal social cues guiding these interactions remain incompletely understood. We conducted three behavioural studies focusing on the execution (Exp.1) and observation (Exp. 2 & 3) of a basic motor act—grasping an object—leveraging ecological stimuli and settings. In Experiment 1 (n=14) we compared actions executed with individualistic (grasp to place) or social (grasp to pass) intentions, employing hand kinematics analyses. Grasping with a social intention exhibited slower, more precise execution and distinct hand placement on the object.

Recordings of actions from this first study were used in two subsequent action prediction experiments where either the participants' arm (Exp. 2, n=40) or both face and arm (Exp. 3, n=40) were visible.

In Experiment 2, classification analysis revealed hand positioning on the grasped object as a major predictor of participants' responses; lower hand placement correlated with perceiving actions as socially directed. This aspect, overlooked in previous studies, may be linked to social affordance processing, reflecting the space available for potential interaction.

Experiment 3, employing eye-tracking analysis, identified the face as the primary attended feature. However, with less reliable face cues, attention shifted to arm velocity and hand placement on the object.

Our results unveil potential markers of social intentions in motor acts, emphasizing individuals' reliance on multiple bodily cues for action predictions in naturalistic interactions. This comprehensive approach sheds light on the nuanced interplay between motor actions and social cognition, offering valuable insights into the dynamics of human interaction.

Location: Auditorium 4

Oral talks 8: Agency, Body, and Touch

Conscious awareness in the sense of body ownership: An approach using computational models of metacognition and perceptual evidence accumulation

Renzo Lanfranco, August Hägerdal, Xiaole Luan, Sucharit Katyal, H. Henrik Ehrsson

The sense of owning one's body arises from the integration of multiple sensory signals. How are these multisensory signals accumulated over time and how do they gain access to awareness? To induce and manipulate body ownership, researchers typically use the rubber hand illusion (RHI), which involves stroking a person's hidden hand alongside a visible fake rubber hand placed in front of them; this induces the feeling that the rubber hand is their own. Here, we use a body ownership psychophysical paradigm that objectively quantifies body ownership processing in a bias-free manner by simultaneously inducing the RHI with two rubber hands. Graded stimulation asynchronies between them are introduced using robot arms, and participants must report which rubber hand feels most like their own and rate their subjective experience. We present two experiments that have been analysed using type-1 and 2 signal detection theoretic (SDT) analyses to test how different visuotactile manipulations modulate perceptual and metacognitive body ownership sensitivity. We present two more experiments in which we used SDT, drift-diffusion modelling (DDM), and v -ratio (a newly developed DDM parameter that quantifies metacognitive access) to test how multisensory evidence is accumulated during the RHI while accounting for the speed-accuracy trade-off. Together, our results indicate that the multisensory signals behind the sense of body ownership enjoy continuous access to conscious awareness, both when using static and dynamic metrics of perceptual evidence accumulation, which strongly supports the notion that body ownership is a crucial component of self-awareness.

Location: Auditorium 4

Oral talks 8: Agency, Body, and Touch

Tactile discrimination is associated with social touch preference in two cross-cultural cohorts

Helen Powell, Jason He, Nicolaas Puts

Social touch plays a vital role in social bonding and cognition. However, the mechanisms underlying how social touch elicits pleasant or aversive responses remain unclear. Furthermore, the role of sensory perception (i.e. detecting and discriminating stimuli) in shaping these responses, as well as the impact of contextual factors, such as gender and cultural differences, are not fully understood.

Here, we investigated social touch pleasantness in 48 adults: 26 from the UK (18-38 years; 15 Female, 11 Male) and 22 from Singapore (21-37 years; 13 Female, 9 Male). Social touch preference was assessed using a novel, quantitative Social Touch Task, which presented images of dyadic social touch interactions involving different touch partners. Tactile perception was measured using vibrotactile psychophysics. Questionnaires on social touch were also assessed.

Across both cohorts, female participants rated touch from a friend or stranger of a different gender as less pleasant than males. Singaporean adults rated touch from a friend as less pleasant than those in the UK cohort. Interestingly, participants with higher amplitude discrimination thresholds in both cohorts had a lower preference for social vs. non-social touch in the Social Touch Task, and had lower preference scores in the social touch questionnaires.

These findings suggest a link between poorer tactile discrimination and lower subjective pleasantness of social touch in adults. Furthermore, while some cultural differences between cohorts were observed at the contextual level, perceptual contributions to social touch preference were conserved. These findings could have implications for neurodevelopmental conditions involving atypical social and sensory processing.

Location: Auditorium 4

Oral talks 8: Agency, Body, and Touch

Touch in preterm infants - C-tactile activation and autonomic regulation

Yvonne Friedrich, Ilona Croy

Various studies have shown physiological and psychological stress buffering effects of gentle human touch. These effects may be particularly important for preterm infants, who often experience autonomic dysregulation that can lead to life-threatening conditions.

Microneurography studies suggest that a subtype of nerve fibers, called C-tactile afferents, play a special role in mediating affective touch. C-tactile fibers are activated by slow stroking (1-10 cm/s) and have a calming effect on the autonomic nervous system.

In two studies, we investigated whether C-tactile targeted stroking leads to a calming effect (i.e. lowering of heart rate, reduction of stress behavior) on the immature autonomic system of preterm infants. We investigated whether (a) mothers intuitively use stroking speeds that are suitable to target C-tactile fibers, (b) the heart rate of preterm infants decrease in response to C-tactile optimal stroking, and whether (c) this decrease is more pronounced during stroking than during static touch.

The first study involved $n = 32$ preterm infants who were stroked by their mothers and the second study involved $n = 36$ preterm infants who were stroked by a trained experimenter. Physiological and behavioral responses were recorded.

The analyses indicate that the mothers used stroking speeds within the optimal range and the preterm infants showed a significant but delayed calming response to the mothers' stroking. The results of the second study were less supportive of the hypothesis. This indicates that the maturation process is still ongoing and could potentially be promoted by C-tactile activation strategies like stroking.

Location: Auditorium 4

Oral talks 8: Agency, Body, and Touch

Low autonomic arousal alters frequency of mind blanking reports.

Paradeisios Alexandros Boulakis, Federico Raimondo, Stefania Zoi, Sepehr Mortaheb, Christina Schmidt, Athena Demertzi

The inability to report immediate mental content is termed mind-blanking (MB). Although the link between MB and cortical arousal is established, what remains inconclusive is whether MB can also ensue from autonomic arousal manipulations. In this registered report (<https://osf.io/nfcvu/>), we employed experience-sampling under different autonomic arousal conditions while multimodal brain-body recordings were taking place. During baseline measurements, 26 participants (11 female) reported their thoughts every 2 minutes, by opting across a) sensations, b) mind-wandering and c) blank. The protocol was repeated in counter-balanced order in a high-arousal (high-intensity exercise) and a low-arousal condition (8-hour sleep deprivation). According to our hypothesis, we found that MB reports were more frequently reported in the low arousal condition compared to baseline ($b = -.794$, $pFDR < .000$) and high arousal ($b = -.968$, $pFDR < .000$). Contrary to our hypothesis, there was no increase in MB reports the high arousal condition compared to baseline ($b = .173$, $pFDR = .237$). To examine whether MB reports could be predicted from a unique brain-body matrix, we opted for a machine learning approach by training a balanced random forest classifier. In line with our hypothesis, we found that a combination of brain and body features outperformed chance level and classifiers trained solely on brain or body features. Our results stress that MB is an arousal-modulated mental state. They also suggest that peripheral physiology carries unique information about MB that cannot be encapsulated solely in brain activity. Overall, we show that an embodied approach to studying ongoing thinking outperforms a neurocentric approach and provides greater explanatory power in understanding MB.

Location: Auditorium 1
Oral talks 9: Emotion I

Investigating empathic reactions in toddlers by using wearable fNIRS in a novel immersive virtual reality set-up

Chiara Bulgarelli, Paola Pinti, Nadine Aburumman, Emily Jones

Empathy, sharing emotions and knowing they come from others, is critical for social interactions (Bernhardt, 2012). As failures in empathy characterise children with antisocial behaviours (Frick, 2014), understanding empathy development is essential for guiding early interventions.

Empathy emerges after the second year of life, but to date its development is unclear. We lack suitable experimental approaches for studying toddlers, who struggle to comply with strict testing-lab rules. Moreover, traditional assessments of social development do not capture the complexity of social interactions (Wass&Jones, 2023).

Empathic reactions of 50 3-to-5-year-olds are assessed in the world's first Birkbeck ToddlerLab Cave Automatic Virtual Environment (CAVE), while measuring their brain activations from the frontal and temporal cortex using wearable functional near-infrared spectroscopy (fNIRS). This set-up was successfully validated for the study of toddlers' social preference (Bulgarelli, 2023). Participants will be interacting with toddler-like avatars during emotionally connoted situations, such as helping a toddler-avatar who fell from a trampoline. Similar emotionally relevant scenarios will be presented to the same participants in a standard screen-based task.

Data collection is ongoing; I will present preliminary results from this innovative CAVE/fNIRS set-up. I will compare toddlers' behavioural and neural markers of empathy while actively interacting with toddler-avatars with those elicited using a passive screen-based task. 43 3-to-5-year-olds assessed with the screen-based task showed greater activations over the frontal and temporal cortex for emotionally connoted vs. neutral scenarios.

This study advances our understanding of toddlers' social world, and provides a future reference for using naturalistic methods to explore toddlers' development.

Location: Auditorium 1

Oral talks 9: Emotion I

Emotion regulation – a new RDoC construct?

Carmen Morawetz, Angela Laird

Diverse psychopathologies share the element of emotion dysregulation. The National Institute of Mental Health introduced the Research Domain Criteria (RDoC) initiative to better understand the nature of mental disorders from a transdiagnostic perspective. Within the RDoC framework, six major domains of human functioning have been defined. Considering the conceptual transdiagnostic features inherent in emotion regulation, there arises the question of whether it should be treated as an independent research domain. One strategy for assessing this criterion is to investigate if this concept is supported by a biologically distinct system of the brain.

We used coordinate-based meta-analyses to identify consensus across and differences between the existing RDoC domains and emotion regulation. Data from ten previously published meta-analyses representing the constructs of the existing RDoC domains were reanalyzed to examine the unique brain regions linked to the emotion regulation construct versus all other RDoC constructs. The analyses were based on a final meta-analytic dataset of 3.473 experimental contrasts among a total of 78.521 healthy adults. Emotion regulation overlapped with each RDoC domain indicated by the Dice index, except for the arousal and regulatory systems: valence systems (6%), cognitive systems (attention: 2%; cognitive control: 11%; declarative memory: 3%; language: 14%; perception: 6%; working memory: 11%), social processes (13%), and sensorimotor systems (2%). Given the relatively small overlap with other RDoC domains (7% on average), this work provides neural support for the idea of emotion regulation as a new RDoC domain.

Location: Auditorium 1
Oral talks 9: Emotion I

Hierarchy in the social categorization of faces: The primacy of emotions.

Delphine Pins, Kuzma Strelnikov, Pascal Gaillard, Justin Terrace, Olivier Deguine, Pascal Barone

Social categorization is a fundamental self-referential mechanism identified in social psychology. Indeed, we automatically classify the people with whom we interact into various social categories, allowing activating beliefs about them to adapt our social interactions. However, the same person can belong to several categories (socio-economic, gender, age...). Moreover, in the context of social interaction, individuals not only categorize others according to their social characteristics, but they also consider the facial expression of the face.

Our study addressed the fundamental question of how we process faces when various category memberships are available, with the hypothesis that all categories are activated in parallel and compete with each other, creating a hierarchy in our categorical perception.

We adapted a paradigm mainly used in consumer behavior studies, the Free Sorting Task (FST), to assess on nearly 150 participants the hierarchical organization between the main social categories used to discriminate human faces (i.e., ethnicity, gender, age, familiarity) and emotion. A hierarchical clustering analysis based on principal components coupled with multiple correspondence analysis demonstrated that the social attributes of a human face, including emotion, are represented hierarchically. Emotion outperforms all social information without changing the hierarchical order of the other social categories, with first age, then gender, and subsequently ethnicity and familiarity. This rank in the hierarchy of categories suggests that dominant categories are those that triggers in priority the adapted behaviour. The questions of how such a hierarchy is established during development, and how it can be disrupted during life, remain open.

Location: Auditorium 1

Oral talks 9: Emotion I

Mood variability development in adolescence and its relation to biological mechanisms

Yara Toenders, Renske van der Cruijssen, Jana Runze, Suzanne van de Groep, Lara Wierenga, Eveline Crone

Mood swings, or mood variability, are associated with negative mental health outcomes. Since adolescence is a time when mood disorder onset peaks, mood variability during this time is of significant interest. Understanding biological factors that might be associated with mood variability, such as sleep and structural brain development, could elucidate the mechanisms underlying mood and anxiety disorders. Data from the longitudinal Leiden Self-Concept study (N=191) over 5 yearly timepoints was used to study the association between sleep, brain structure, and mood variability in healthy adolescents aged 11-21 at baseline in this pre-registered study. Sleep was measured both objectively, using actigraphy, as well as subjectively, using a daily diary self-report. Negative mood variability was defined as day-to-day negative mood swings over a period of 5 days after an MRI scan. It was found that negative mood variability peaked in mid-adolescence in females while it linearly increased in males, and average negative mood showed a similar pattern. Sleep duration (subjective and objective) generally decreased throughout adolescence, with a larger decrease in males. Mood variability was not associated with sleep, but average negative mood was associated with lower self-reported energy. In addition, higher thickness in the dorsolateral prefrontal cortex (dlPFC) compared to same-age peers, suggesting a delayed thinning process, was associated with higher negative mood variability in early and mid-adolescence. Together, this study provides an insight into the development of mood variability and its association with brain structure.

Location: Auditorium 1

Oral talks 9: Emotion I

Looking into troubled waters: Does childhood emotional maltreatment modulates neural responses to prolonged gazing into one's own and others' eyes?

Mirjam Wever, Lisanne van Houtum, Loes Janssen, Wilma Wentholt, Geert-Jan Will, Marieke Tollenaar, Bernet Elzinga

Childhood emotional maltreatment (CEM) is associated with the development of negative cognition about the self and others. This can put people with a history of CEM at a greater risk for developing internalizing disorders and contributes to problems in the formation and maintenance of (intimate) relationships. Prior studies have shown altered processing of eye contact in people with a history of CEM. The current study examined whether CEM in adults and adolescents is associated with their neural, affective, and gaze responses when gazing into one's own and others' eyes. Seventy-eight adolescents and sixty parents viewed videos with direct and averted gaze of themselves and an unfamiliar other in the scanner while we recorded self-reported mood, eye movements using eye-tracking, and markers of neural activity using fMRI. CEM was assessed with the CTQ. Adult participants who reported higher levels of CEM exhibited increased activity in ventromedial prefrontal cortex to one's own, but not to others', direct gaze. Furthermore, in contrast to those who reported fewer of such experiences, they did not report a better mood in response to a direct gaze of self and others, despite equivalent amounts of time spent looking into their own and other people's eyes. Data of adolescents has yet to be analyzed. The fact that CEM is associated with enhanced neural activation in a brain area that is crucially involved in self-referential processing (i.e., vmPFC) in response to one's own direct gaze is in line with the chronic negative impact of CEM on a person's self-views.

Location: Leslokaal 1.2

Oral talks 10: Social Influence

Commanding or being a simple intermediary: how does it affect moral behavior and related brain mechanisms?

Kalliopi Ioumpa, Emilie Caspar, Valeria Gazzola, Christian Keysers

Psychological and neuroscientific research has demonstrated that dividing operational tasks across multiple individuals within a hierarchical structure distributes responsibility and enhances antisocial behaviors. Here we present two studies, employing functional magnetic resonance imaging (fMRI) and electroencephalography (EEG), investigating the impact of commanding or occupying an intermediary hierarchical position on the sense of agency and empathy for pain. In the context of contemporary military technology involving drones, we investigated ordering both a human and a robotic executor. We utilized a paradigm where participants make decisions to administer or refrain from administering painful shocks to another participant in exchange for monetary rewards. The fMRI results showed that activation in brain regions associated with social cognition and empathy (as IFG, IPL and SII) remained consistently low when witnessing a victim experiencing pain, whether the participant had a commanding role or acted as a simple intermediary conveying orders, as opposed to being the direct executor administering the shocks. Findings revealed no significant difference in the sense of agency between commanders and intermediaries, irrespective of whether the executing agent was a human or a robot. An increased neural response, particularly in the P3 event-related potential, was observed when the executing agent was a robot compared to a human. EEG signal source reconstruction showed the involvement of areas such as the insula and ACC in mediating this effect. These results shed some more light on how hierarchical situations can facilitate the commission of actions that harm others as responsibility is reduced and split across multiple individuals.

Location: Leslokaal 1.2

Oral talks 10: Social Influence

Shared Rhythm to Shared Vision: Synchronous Marching increases Conformity on Perceptual Decision making

Manisha Biswas

Engaging in group rituals that incorporate synchronous movement can sometimes create a sense of euphoric collective effervescence, which has been associated with self-reported measures of prosocial propensity towards the synchronised group and increased reliance on group opinion. However, shifts in perceptual decision-making resulting from synchronous movement have yet to be established.

In this novel virtual reality experiment, we examined whether marching synchronously with a group can induce greater informational conformity on an unrelated perceptual task (forced-choice random dot motion) by eliciting identification with the synchrony-induced minimal group. We found higher reported levels of self-other blurring for the synchronous, as compared to the asynchronous, marching group. Crucially, participants displayed a higher degree of informational conformity following synchronised marching on hard and ambiguous trials.

This finding indicates that interpersonal synchrony may induce minimal group membership, increasing self-other blurring and conformity. Thus, participation in synchronised rituals has the capacity to change perceptual judgements of the world to align more closely with the synchronised group. These results indicate that participation in synchronous action increases susceptibility to the social influence of group decision and adds to the growing evidence that early perceptual faculties are permeable to higher-order processes of group identification.

Location: Leslokaal 1.2

Oral talks 10: Social Influence

Unveiling the Digital Influence: Neural Underpinnings of Social Media Impact on Opinion Formation

Federica Nisini

This study examined the impact of digital social information on opinion formation in a social media context and the neural processes underlying this process.

Social media are increasingly becoming an important source of news at the expense of traditional newspapers. Unlike the latter, readers of news on social media are confronted with both the news and the reactions of other readers to this news at the same time. Recent studies have shown that people are likely to read comments before the body of the article and spend more time reading the comments than the article itself. However, the neural mechanisms implicated in the influence of social information gathered online on opinion formation are still largely unknown.

In a novel fMRI paradigm, 40 participants expressed their opinions about 18 real news headlines on controversial contemporary topics (climate change, vaccination, veganism) posted on Facebook before and after reading comments written by other real users. These comments were either supportive, opposing, or unrelated to the news headlines. Results revealed opinion adjustment in alignment with the comments, particularly when the comments diverged from participants' initial opinions. Neurally, increased activity in selected regions of the Theory of Mind network (angular gyrus, precuneus, middle frontal gyrus) was observed when participants engaged with user comments. These effects were smaller in participants holding stronger attitudes toward the discussed topics.

Our findings suggest that social media users are highly susceptible to the influence of other people's opinions when engaging with online news, including contemporary topics with pressing societal relevance.

Location: Leslokaal 1.2

Oral talks 10: Social Influence

Changing minds, shifting biases: investigating confirmation bias dynamics in the face of changing opinions.

Charlotte Anckaert

People tend to discount information that contradicts their own belief, a phenomenon called confirmation bias. People are also influenced by how strongly or confidently new information is shared. Kappes and colleagues explored the relation between confidence and confirmation bias. Participants were allowed to update their confidence in a belief after receiving new information from another person that (dis)confirmed their initial belief. The information was expressed with varying levels of confidence. A confirmation bias was observed but interestingly, the strength of the new information was considered only if it was confirming. In real life, however, besides updating confidence in beliefs, we also have the possibility to change the belief itself. It is currently unknown what changing beliefs does with confidence in beliefs. We investigated this question in two studies. A first study replicated Kappes et al. while a second study added the option to change the belief. Both studies replicated the finding that another's belief strength is only considered when the information is confirmatory. However, an overall confirmation bias was not observed. Instead, it appeared as an interaction with confidence: a regular confirmation bias occurred when the other person was more confident and reversed when the other was less confident. Finally, when participants changed their belief, a large drop in confidence was found. The largest drop was observed when the other person was less confident. These findings highlight that the confirmation bias is a social construct, defined by the belief strength of another person and sensitive to belief change.

Location: Leslokaal 1.2

Oral talks 10: Social Influence

Do people follow rules irrespectively of its origin? Influence of social groups on rule compliance

Dominik Suri, Simon Gächter, Sebastian Kube, Johannes Schultz

Social life is governed by rules. Thus, it is crucial to understand drivers and barriers to rule-following behavior. Using a between-subject design, we investigate the impact of one determinant of rule-following on rule compliance, namely the origin of the rule. In our very simple task, participants are asked to follow an arbitrary rule. The rule is devoid of moral content, following it leads to a small monetary loss, while violating it has no negative consequence. Across participant groups, the rule is attributed either to the researchers (control group), to an in-group member (treatment group 1) or to an out-group member (treatment group 2). The results show generally high rule-compliance in the control group comparable to similar previous studies, and similarly high compliance to the rule attributed to the in-group. If the rule is attributed to an out-group member however, compliance significantly drops. Thus, the origin of an arbitrary rule seems to be a determinant of people's tendency to follow it; specifically, compliance drops if a rule is attributed to an out-group. This finding may be of use to policy-makers desiring to nudge rule compliance levels by building on in- and out-group associations.

Friday, May 24th 2024 // 2:00pm - 3:30pm

Location: Leslokaal 1.3

Oral talks 11: Decision making I

The Controllosphere: A Control-theoretic Account of Cognitive Effort and its Neural Origins

Clay Holroyd

Why do some mental activities feel harder than others? In this talk I introduce the concept of the "controllosphere," an energy-inefficient region of neural state space associated with high control, which surrounds the better-known "intrinsic manifold", an energy-efficient subspace associated with low control. Integration of control-theoretic principles with classic neurocomputational models of cognitive control suggests that dorsolateral prefrontal cortex (DLPFC) implements a controller that can drive the system state into the controllosphere, anterior cingulate cortex (ACC) implements an observer that monitors changes of state of the controlled system, and cognitive effort reflects a mismatch between DLPFC and ACC energies for control and observation. I further propose that neural transitions through the controllosphere lead to a buildup of neural waste. Cognitive effort therefore prevents against neural damage by discouraging extended periods of high control.

Location: Leslokaal 1.3

Oral talks 11: Decision making I

Computational drivers of advice-giving during reinforcement learning

Anllo Hernan

Individuals often rely on the advice of more experienced peers to minimize uncertainty and increase success odds. However, little is known about the computational and cognitive dynamics underlying the decision of giving advice to others, and the link between accuracy and tendency to give advice. We ran a series of experiments implementing a learning decision task within a reinforcement learning framework, as means to evaluate learners' tendency to broadcast their own experiential learning to others. Participants had to decide whether to broadcast their choices as advice on a trial basis, with different costs and benefits associated with advice. Our results show that tendency to advise increases with the progression from exploratory to exploitative choice behavior regardless of advice cost. Advice calibration with decision accuracy, and overall advice frequency was affected by advice incentives, either when advising was costly or beneficial to the adviser. These results indicate that learning from advice may be more efficient than learning from observation, and the boundary conditions restricting this strategy.

Location: Leslokaal 1.3

Oral talks 11: Decision making I

Cascading recall bridges between episodic memories and semantic knowledge

Achiel Fenneman, Claus Lamm

We can draw on both episodic memories and semantic knowledge to guide behavior in novel situations. Despite growing interest in the interplay between these systems, key questions remain. It remains unclear how we learn abstract representations between features that may rarely occur together – and how these latent representations are combined to form hierarchical semantic knowledge structures. Additionally, it remains unclear how these semantic representations can guide the retrieval of episodic memories. By bridging insights from memory-neuroscience with findings in memory-based decision-making, we propose that the sequential sampling of related experiences offers valuable insights. Such cascading recall forms an internal source of information to facilitate the Hebbian learning of abstract representations and allows for the bootstrapped learning of higher-order semantic knowledge through the co-activation of lower-level latent representations. Finally, these semantic representations provide a top-down guidance to facilitate the sampling of episodic memories along semantically similar features. We validate these predictions by conducting three naturalistic online experiments in a paradigm previously designed to elicit the sequential recall of indirectly related experiences. These experiments demonstrate that the sequential recall of memories increases the judged semantic similarity of their constituent features, and the sequential activation of two latent groups increases their higher-order semantic similarity. In addition, we demonstrate that memories with semantically similar features are more likely to be sequentially recalled. These findings support the role of cascading recall in the interplay between semantic knowledge and episodic memories, with implications for cognitive science, including sleep-related learning and AI research.

Location: Leslokaal 1.3

Oral talks 11: Decision making I

Autistic traits and dealing with uncertainty; a comparison between non-diagnosed and diagnosed individuals

Fien Goetmaeckers, Judith Goris, Roeljan Wiersema, Tom Verguts, Senne Braem

In navigating a world with an abundance of novel choice options, we often rely on past experiences to predict how much we would enjoy both previously chosen and novel choice options. The uncertainty of novel options is an important driver in decision-making, leading some people to explore to gain new insights over exploiting known rewards. Such exploration in experiments with small decision spaces has been proven to correlate with clinical traits such as Autism. In this study, we used vast decision spaces to investigate the relationship between autism (traits) and different exploration strategies, since most of our everyday decisions are made in such vast decision spaces. Non-diagnosed ($n = 509$) and diagnosed participants ($n = 77$) accumulated rewards in a spatially correlated multi-armed bandit task by sampling tiles on a square grid of 121 choice options. Since individuals with autism or high autism traits are typically thought to avoid unpredictability (compared to typically developed participants), we expected participants scoring higher on autism scales to show less exploration and more exploitation. Interestingly, while participants with autism diagnosis explored less, we found a reverse relationship between autism traits and exploration in the non-diagnosed group. There, more autism traits lead to more exploration. Our behavioral and computational findings further suggest important differences between people with and without an autism diagnosis in dealing with uncertainty.

Location: Leslokaal 1.3

Oral talks 11: Decision making I

Pupil size predicts strategy use in complex decision-making

Jakub Cacek, Szymon Wichary, Bartłomiej Król-Józaga, Henk van Steenbergen, Sander Nieuwenhuis

When faced with complex choices, people can rely both on complex and simple strategies to make the decisions. The difference in the effort required to perform such strategies should be reflected in pupil size, because pupil size is a well-established measure of cognitive effort, linked to information processing in many domains. In the present study (N = 24), we tested if 1) pupil size measured before a choice task is associated with the preference for a particular (complex vs. simple) strategy across the task, 2) task-evoked pupil size can predict a consistent preference for the use of a particular strategy across the task, and 3) task-evoked pupil size changes can predict strategy use trial-by-trial. To test these hypotheses, we used a multi-attribute decision task, in which participants acquire cues about the value of two diamonds, and based on them, they decide which of the two diamonds to choose. With continuous measurement of pupil size, using generalized linear mixed effects models, we showed that 1) participants with larger baseline pupil size have a greater tendency to use a simple strategy during the task, 2) participants preferring the complex strategy have larger pupils across the task, and 3) larger task-evoked pupil size predicts the use of the complex strategy on a given trial. These results extend previous findings demonstrating that pupil size dynamics is a valid measure in complex decision-making, and they are novel in showing that pupil size can predict decision strategy use.

Location: Leslokaal 3.2

Oral talks 12: Interoception

Approach-avoidance conflict resolution is related to trait anxiety and interoception

Andreas Frick, Johanna Motilla Hoppe, Johan Vegelius, Malin Gingnell, Tomas Furmark, Johannes Björkstrand

Approach-avoidance conflicts arise in situations with simultaneously aversive and rewarding outcomes. Avoidance in such situations is costly, as this leads to loss of reward, and is potentially driven by anxiety levels. To further elucidate the relation between anxiety levels and costly avoidance, we conducted three studies with an experimental task consisting of choices between viewing a generally aversive image+sound or a neutral image+sound. The aversive choice was rewarded with varying reward levels, while the neutral choice was not. First, using an online experimental task with arbitrary points as rewards in 186 adults from the general population, we show that higher reward-points lead to more approach and that higher trait anxiety levels are associated with more costly avoidance. In a lab-based study of 40 individuals with either high or low social anxiety levels, we extend these findings by replicating the pattern of increased approach behavior to higher monetary reward levels and elevated costly avoidance in the high social anxiety group. We then conducted a double-blind, placebo-controlled acute 150mg caffeine challenge in 28 patients with panic disorder and 52 individuals without psychiatric disorder, replicating the patterns of higher reward levels leading to more approach and that patients had more costly avoidance. Moreover, across both groups, caffeine acutely increased costly avoidance, an effect associated with attentional impairment caused by awareness of bodily symptoms. Taken together, we demonstrate that costly avoidance is associated with high trait anxiety levels and highlight the importance of interoceptive processing for approach-avoidance conflict resolutions.

Location: Leslokaal 3.2

Oral talks 12: Interoception

Heart rate scales with prediction error

Maria Azanova, Lina Skora, Alina Studenova, Esra Al, Vadim Nikulin, Arno Villringer

Recent conceptualizations of cardiac deceleration in adaptive environments suggest that heart slowing improves the precision of perception by reducing the frequency of noisy events associated with heartbeats. Prediction error, the difference between an expectation and an outcome, is key to the learning process and signals a need to integrate new evidence. However, it is unclear how heart rate scales with various prediction errors and how such heart rate dynamics relate to the neural reaction to feedback. To investigate this, we combined EEG and ECG recordings during a probabilistic learning task in 37 participants. We used computational modeling (Q-learning) to extract prediction errors and Bayesian mixed linear models to examine their interaction with cardiac and neural responses. To study cardiac responses, we assessed the change in the inter-beat interval (IBI) of the first heartbeat after feedback. To study neural responses, we computed average amplitudes of feedback-related negativity (FRN) and P300. We found that heart rate slowed more with larger prediction errors. Furthermore, only when feedback appeared earlier in the heart cycle phase (i.e., systole) was heart slowing positively associated with P300 but not with FRN. Therefore, we show it is possible to detect instant IBI scaling with prediction error. Our findings provide insight into the cardio-behavioral states involved in learning and highlight the critical role of heart slowing. This has further implications for understanding how cognitive processes are affected by disturbances in heart-brain interactions, e.g., for learning in anxiety.

Location: Leslokaal 3.2

Oral talks 12: Interoception

General and Anxiety-Linked Influence of Acute Serotonin Reuptake Inhibition on Neural Responses Associated with Attended Visceral Sensation

Daniel Campbell-Meiklejohn, James Livermore, Kris Adamatzky, Sarah Garfinkel, Lina Skora, Hugo Critchley

Serotonin can state-dependently modulate exteroceptive sensory processing and pain, but much less is known about its role in ordinary interoception and its relationship to affective states. This within-subject neuroimaging experiment compared the impact of an acute increase of extracellular serotonin (by a selective serotonin reuptake inhibitor (20mg Citalopram) to the impact of a placebo on the neural processing of ordinary interoceptive sensations and the relationship of this impact to levels of anxiety. Twenty-one healthy young volunteers completed a visceral interoceptive attention task with each treatment, at least 1 week apart (42 sessions total), focusing attention on heart, stomach, or visual sensation control while scanned with functional magnetic resonance imaging. The relative neural interoceptive responses (IR) to heart and stomach sensations were compared between treatment conditions, controlling for general effects on sensory processing (subtracting effects on response to visual attention). Citalopram generally reduced interoceptive processing in viscerosensory (bilateral posterior insular cortex, stomach-IR) and integrative/affective components (bilateral amygdala, stomach-IR and heart-IR) of known interoceptive pathways. We then searched for state-dependent modulatory effects of Citalopram that varied with levels of anxiety. Anterior insular heart-IR increased with anxiety, replicating prior findings. This relationship, however, disappears on Citalopram, with a significant treatment x anxiety interaction effect. Preliminary post hoc exploration found that Citalopram's effects on amygdalae response to stomach sensation predicted acute increases and decreases in anxiety. This evidence of general and state-dependent serotonergic influence on interoception advances our understanding of interoceptive regulation and opens a new path for understanding serotonergic influence on affective states.

Location: Leslokaal 3.2

Oral talks 12: Interoception

Virtual Reality Biofeedback in an Arousing Action Game Improves In-Action Heart Rate Variability Control in Police Trainers

Floris Klumpers, Abele Michela, Jacobien van Peer, Robert Oostenveld, Annika Smit, Wendy Dorrestijn, Isabela Granic, Karin Roelofs

Adequate control over evolutionary engrained bodily stress reactions is essential to avoid disproportionate responses during highly arousing situations, especially in first responders such as police. This regulation can be trained via heart rate variability (HRV) biofeedback, a widely used intervention aiming to improve stress regulation, but typically conducted under passive, low arousing conditions. By integrating closed-loop HRV biofeedback in an engaging Virtual Reality (VR) action game designed to contain the behavioral elements typically compromised under stress we trained in-action physiological self-control under high arousal to allow improved transfer to real-life situations. A pre-registered (<https://osf.io/cdsbx>) quasi-randomized controlled trial in 109 Dutch police trainers demonstrated 32% average increases in in-action HRV, through the engaging and gamified closed loop biofeedback. The ability to voluntarily upregulate in-action HRV could be demonstrated game sessions without biofeedback (near transfer). We could additionally demonstrate transfer to a shooting assessment outside VR (far transfer). These results suggest that real time-biofeedback in stressful and active action contexts is feasible and can help train professionals such as police in real-life stress regulation.

Location: Leslokaal 3.2

Oral talks 12: Interoception

Can people identify the likely owner of heartbeats by the sound of their voice?

Nadia Guerouaou, Matthieu Fraticelli, Paul Maublanc, Guillaume Vaiva, Jean-Julien Aucouturier

This study explores the possibility that heart rate, a physiological signal indicative of a person's psychophysiological state (Thayer et al., 2012), can be perceived in individuals' speech production, similarly to what has been recently demonstrated for faces (Galvez-Pol et al., 2022).

We first conducted a physiology study adapted from the clinical protocol of tilt-test (Aponte-Becerra & Novak, 2021), in which $N=27$ healthy participants were tasked to lie down for 15min, and then rose quickly to standing position before recording 15 successive vocalizations of an isolated vowel, while their blood pulse was recorded with photoplethysmography (PPG). Results show a systematic, and to our knowledge scarcely investigated (Orlikoff & Baken, 1989), relation between heart rate and vocal pitch, at the rate of +10Hz for a +20 bpm increase.

In a second study, we presented a selection of voice samples recorded from these participants to another group of $N=29$ participants, and adapted the original Galvez-Pol paradigm to test whether participants were able to correctly assign a given heart beat recording to one of two possible voice extracts. While participants were overall not able to do the task above chance, they were when we restricted trials to voices compared within-speaker, and to extracts exhibiting with the strongest pitch to bpm relationship ($d'=0.2$, $t(28)=3.16$, $p=0.003$).

Together, these results lead us to consider voice as a potential vehicle for information about the cardiac signal, with theoretical consequences both for social cognition and interoception.



May 24th – 5:00pm – 6:30pm

SYMPOSIA

Friday, May 24th 2024 // 5:00pm - 6:30pm

*Location: Auditorium 2
symposium 25*

Artificial agents as tools to explore the (human) Self

Cecilia Roselli, Agnieszka Wykowska,

In this symposium, we will demonstrate how artificial agents (avatars, robots) can be used as a tool to explore the Self. Artificial agents allow a high degree of ecological validity without sacrificing experimental control. Artificial agents can inform about the human Self in three different ways: (1) as sophisticated apparatus in experimental protocols; (2) as embodied computational models of mechanisms underlying the Self; (3) as models of the diversity of the Self. The speakers will cover the areas of research on the Self, ranging from experimental approaches, through computational modelling to clinical aspects.

Talk 1 - Tony Prescott

Synthesizing the embodied self: A robotics perspective

This talk will consider the specific challenge of synthesizing a robot “sense of self”. The starting hypothesis is that the human self is brought into being by the activity of a set of transient self-processes instantiated by the brain and body. The proposal is that we can understand this self-system, and thereby this core aspect of the human condition, through embodied (robotic) modelling. The self begins with the brain’s discovery of the body, of its ability to control it, and of the distinctive dynamics of interoceptive compared to exteroceptive sensory signals. These processes give rise to a minimal sense of self as a bounded agent, upon which layers of reflective self-processes are constructed that extend the self in space and time and that allow the recognition of other selves. To illustrate the talk, I will discuss ongoing attempts to create a sense of self for robots within my own lab and others.

Talk 2 - Pablo Lanillos

Robot in the mirror: toward an embodied computational model of mirror self-recognition

The Mirror Self Recognition (MSR) test has been used since 1970 after Gallup Jr. as a validation of self-identification and, more controversially, as a consciousness proof. After all these years, we are still far from understanding all the underlying processes and the required cognitive components to pass the test and its relation to self-awareness. In this endeavour, some roboticists are trying to investigate this test in machines and study the mechanisms behind. I will show a robot that (partially) passes the MSR test using a computational model based on the predictive processing account to cognition. Is this robot self-aware? The short answer is: no. However, the mechanistic decomposition of all processes involved shows the essential backdrop of body self-awareness and its connection to behaviour, also known as the active self.

Talk 3 - Zeynep Barlas

Sense of agency in human- versus robot-guided actions

Sense of agency (SoA) refers to experience of control over one's actions and the consequences of these actions. With increased involvement of various artificial agents in human life, a recently emerged question is whether and how SoA is experienced in tasks performed together with these agents compared to individual or human-human joint actions. In two experiments, the present study investigated SoA in a specific context where human actions were determined by another human vs. a humanoid robot, as compared to when freely selected. Additionally, higher level belief about the robot-autonomy was manipulated via autonomous vs. non-autonomous descriptions of the robot. SoA was assessed through judgment of control ratings and temporal binding (i.e., perceived temporal attraction between voluntary actions and their outcomes) and perceived human-like features of the robot (anthropomorphism, intentionality, decision-making) was measured via a questionnaire. Participants performed free and instructed key presses that produced an auditory tone (Experiment-1) and facial stimuli conveying neutral, positive, or negative valence (Experiment-2). The results revealed greater binding and higher control ratings in free compared to instructed actions, whilst the identity of the instructor (human vs. robot) and the belief in robot-autonomy did not influence the SoA measures. Control ratings were higher for positive compared to neutral and negative outcomes while outcome-valence did not affect binding. Finally, control ratings were positively correlated with how human-like the robot was perceived. These results highlight the role of endogenous processing of action selection and provide preliminary insight into the SoA when actions are guided by artificial agents.

Talk 4 - Cecilia Roselli

(Humanoid) robots as tools to investigate the individual affective dimension of Sense of Agency

Sense of Agency (SoA) is the feeling of control over one's actions and their outcomes. At present, the affective dimension of SoA is still poorly investigated. Therefore, in three experiments we aimed to investigate whether the valence of action outcome modulated participants' implicit SoA, which was assessed by using the temporal interval estimation paradigm. The valence was manipulated through the interaction partner's i) type of facial expression (Experiment 1), ii) type of gaze (Experiment 2), and iii) a combination of both type of facial expression and type of gaze (Experiment 3). The interaction partner was the humanoid robot iCub. In Experiment 1, participants estimated the time interval between the onset of their action (i.e., head movement towards the robot) and the robot's facial expression (happy vs. sad face). Experiment 2 was identical, but the outcome of participants' action was the robot's type of gaze (direct vs. averted gaze). In Experiment 3, we assessed the combined effect of both robot's type of facial expression and type of gaze.

Results showed that, while the robot's facial expression did not affect participants' SoA (Experiment 1), the type of gaze affected SoA in both experiments 2 and 3.

Overall, our findings showed that the communicative gaze is a more potent factor than facial expression in modulating participants' implicit SoA.

Talk 5 - Kay Vogeley

The interpersonal Self during in the interaction with virtual agents

This presentation extends the minimal self of ownership, agency, and unity and will focus on the capacities of communication thereby constituting the interpersonal or social self. Communication presumes that the dyad is the fundamental unit of analysis. With a focus on autism spectrum disorder (ASD) as model disturbance of intuitive, nonverbal communication, the capacities of nonverbal communication in ASD with a special emphasis on gaze and mutual gaze in the interaction with virtual characters are explored. A main result is that persons with ASD in comparison to control persons cannot adequately infer intentions to interact from the gaze behaviour of virtual characters (joint attention). In addition, it can be shown that besides this interpersonal disturbance also the intrapersonal coordination of gaze and gesture is less coherent and integrated in ASD. These results will be integrated into a conceptualisation of successful and disturbed communication. The results have potential implications for diagnosis, therapy, and social re-engagement of persons with ASD and can cross-fertilise the research fields of human-machine interaction, intercultural communication, and computer-mediated communication.

Friday, May 24th 2024 // 5:00pm - 6:30pm

*Location: Auditorium 4
symposium 26*

The neurochemistry of motivation: a computational lens to understand psychopathology.

Hanneke Den Ouden, Massimo Silvetti, Nima Khalighinejad, Matilde Vaghi, Eliana Vassena

Motivation and learning are at the core of human survival. The ability to adaptively exert effort, and pursue rewards is substantially impaired in many psychiatric disorders (eg. OCD, ADHD, depression). Yet, how neurochemical systems supporting motivated behavior contribute to the development of these disorders remains elusive. Combining computational psychiatry, neuroimaging, pharmacology and animal neurophysiology, four experts will discuss the fundamental role of the neurochemicals dopamine and serotonin in supporting motivation and learning. They will present the latest advances in our understanding of maladaptive motivated behavior in ADHD and OCD, and discuss how neuroscience can promote personalized medicine for psychiatric disorders.

Talk 1 - Hanneke Den Ouden

Adaptive biases in motivated action: computations, brain and psychopathology.

Behaviour is not only shaped by ‘rational’ learning from experience, but also by ‘hardwired’ motivational biases, like a tendency to approach and invigorate responding at the promise of a reward. These biases are proposed to provide sensible default ‘fast-and-frugal’ actions (priors), especially helpful when you need to be fast, or the environment unfamiliar. However, exaggerated motivational biases may also lie at the core of mental health problems such as anxiety and mood disorders. If motivational biases can be so harmful, then why are they so persistent? I will first present data from a large-scale online study that shows that the ability to suppress motivational biases adaptively is paradoxically associated with lower mental health. I will then examine whether selective enhancement of cortical dopamine enables adaptive suppression of Pavlovian control when biases are maladaptive, presenting a study where we modulate frontal dopamine with COMT inhibitor tolcapone. Finally, I will discuss a novel take on the adaptive nature of these motivational biases, presenting a recent finding suggesting that their role goes beyond just a ‘default’ response, and that we may adaptively recruit these biases to flexibly support instrumental behaviour.

Talk 2 - Massimo Silvetti

Meta-learning foundations of mesolimbic dopamine dysfunction and cognitive control deficit in ADHD patients.

Attention deficit hyperactivity disorder (ADHD) is a high-prevalence and high-impact neurodevelopmental disorder. At the neurophysiological level, the literature suggests a clear involvement of the mesolimbic and mesocortical dopamine (DA) systems in the pathogenesis of ADHD, while at the cognitive level, dysfunction of both emotional and cognitive functions has been evidenced in many different experimental paradigms. Here we propose a neuro-computational account of how a possible impairment of the mesolimbic DA function can cause a deficit in the optimal allocation of cognitive effort in ADHD patients. We based our hypothesis on a recent neuro-computational model (RML), interpreting the function of a cortical-subcortical macrocircuit - involving the medial prefrontal cortex and the brainstem monoaminergic nuclei - within the framework of meta-Reinforcement Learning. We tested the predictions of our model on a group of ADHD patients and a group of controls that performed a behavioral task leveraging both cognitive control and reward-based decision-making. Thanks to computational phenotyping technique, the RML successfully predicted the monoaminergic dysfunction in ADHD patients and provided a mechanistic explanation of how such a dysfunction leads to cognitive control impairment via maladaptive optimization of cognitive resources allocation. Moreover, machine learning analysis on computational-phenotyping results allowed also a successful discrimination between patients and controls, suggesting different monoaminergic profiles within the patients' group, and thence opening the perspective of a precision medicine of ADHD.

Talk 3 - Nima Khalighinejad

Dorsal Raphe Nucleus controls motivational state transitions in monkeys.

The dorsal raphe nucleus (DRN) is an important source of serotonin in the brain but fundamental aspects of its function remain elusive. We present a combination of minimally invasive recording and disruption studies to show that DRN brings about changes in motivation states. We use recently developed computational methods for identifying temporal patterns in behaviour to show that monkeys change their motivation depending on the availability of rewards in the environment. Specific patterns of DRN activity occur when monkeys transition between a high motivation state occupied when rewards are abundant, to a low motivation state engendered by reward scarcity. Disrupting DRN diminishes sensitivity to the reward environment and perturbs transitions in motivational states, suggesting a potential underlying mechanism for maladaptive reward sensitivity in disorders where serotonergic function is putatively altered.

Talk 4 - Matilde Vaghi

Adaptive learning and precision functional mapping in obsessive-compulsive disorder.

When navigating the environment, we often have to act on incomplete and fragmented information. Typically, incoming information is processed to reduce uncertainty to make more accurate inferences about the causal structure of the environment and act accordingly. In such situations, decisions that we make are guided by the outcomes of similar decisions made in the past. However, we have recently shown that patients with Obsessive-Compulsive Disorder display a behaviour which does not seem to consider

experiences from an extended period, and instead it is constantly influenced by upcoming new information. Here, I will discuss neuroimaging evidence which might account for the brain mechanisms underlying such behaviour and entail fronto-striatal circuits. I will also discuss preliminary findings to make a case for the need to depart from traditional approaches which entail analysis of limited data from each individual and rely on inferences based on subjects' averages, which obscure subject-specific patterns of brain organization. Additionally, the traditional cross-sectional focus provides limited insight into whether observed effects are stable over time or state dependent. This is a major limitation as psychiatric disorders exhibit significant within-subject symptomatic fluctuations over days/months, which can be influenced by therapeutic interventions. I will discuss how moving away from this approach can pave a new avenue towards personalized brain interventions to ameliorate psychiatric symptoms and promote behavioural change.

*Location: Auditorium 1
symposium 27*

Modulatory effects of emotion on attention: recent contributions from human neurophysiology

Gilles Pourtois, Sebastian Schindler, Anne Schacht, Matthias Wieser, Manon Mulckhuyse

Emotional attention refers to the capture of attention by emotion-laden stimuli. In this symposium, five speakers will present novel EEG or TMS results that shed light on this intriguing process. They share in common the use of well-controlled laboratory studies where either EEG or TMS is used, while adult healthy participants perform simple visual tasks and emotion is used as source of information to bias attention. These results give novel insights into the ability to adjust attention control dynamically depending on emotional value, thereby being highly relevant for a wide range of researchers and scholars in cognitive and affective neuroscience.

Talk 1 - Sebastian Schindler

Attention and emotion: Interplay of feature-based attention tasks and emotional relevance during early, mid-latency, and late processing stages

There is an ongoing interest in understanding how limited attentional conditions affect the differential processing of emotional visual information across the processing stream. Recently, the role of specific task conditions that allow the study of the chronometry of differential processing of emotional information gained increasing attention. Here, early (P1, N1/N170), mid-latency (EPN), and late (LPP) modulations of Event-Related Potentials (ERPs) of the EEG represent distinct processing stages and are associated with specific functions. We will provide an overview of recent ERP studies that examined ERP effects of different task manipulations for faces, words, and pictures and different approaches to the emotional relevance of the stimuli. These studies highlight that suited tasks can dissociate different processing stages, aligning with the suggested different functions of early, mid-latency, and late processing stages. Convincingly, early differential amplitude increases for emotional visual stimuli remain intact under different forms of distraction tasks. Mid-latency emotion effects require sufficient attention to the visual stimulus and can be reliably abolished during limited attention to the stimulus, either due to distraction tasks or limited spatial attention—finally, late differential effects or sufficient attention to the emotional meaning of the visual stimulus. However, conflicting findings remain and will be discussed, including experimental factors such as presentation duration that may affect the strict separation of effects. We will present preliminary fMRI studies that aim to localize the origin of the task-dependent chronometry of emotional differentiation. The findings will inform about different theories of visual emotional information processing in the brain.

Talk 2 - Anne Schacht

Emotional attention in the processing of cross-modally associated faces: Behavioral and electrophysiological evidence

Emotional cues from faces and voices are highly relevant and can involuntarily capture attention. Stimuli can also acquire enhanced relevance through learning processes. This study investigated the automaticity of relevance acquisition and the extent to which it subsequently captures attention. In two experiments, neutral faces were paired with affect bursts under different learning and testing conditions, while event-related brain potentials (ERPs) were recorded. In Experiment 1 (N=40), participants learned to match face-voice pairs correctly using a flashcard-style learning task. EPN effects of associated negative valence after learning were independent of the manipulated tasks in the test session, while LPC modulations by associated valence were limited to the explicit valence-classification task. These findings emphasize the importance of the task across different processing stages. In Experiment 2 (N=37), associations were learned in a gender-matching task. The results indicate an automatic processing of task-irrelevant emotion, as evidenced by emotion effects found in auditory, voice-locked ERPs and reaction times (RTs). However, ERPs time-locked to the conditioned faces were primarily modulated by task-relevant information, specifically congruence between the face and voice gender, instead of emotional valence. The ERP and RT effects of learned congruence were not limited to the learning phase but were also evident during testing after the auditory stimuli were removed, indicating successful associative learning. These effects were not limited to the learning phase but did not extend to the task-irrelevant dimension of emotional valence. Therefore, cross-modal associations of emotional relevance may not be acquired automatically, despite processing the vocal emotional content.

Talk 3 - Matthias Wieser

Double threat: The effect of threatening contexts on defensive visuocortical and physiological engagement to conditioned threat

Fear and anxiety are crucial for adaptive responding in life-threatening situations. Whereas fear is a phasic response to an acute threat accompanied by selective attention, anxiety is characterized by a sustained feeling of apprehension and hypervigilance during situations of potential threat. In the current literature, fear and anxiety are usually considered mutually exclusive, with partially separated neural underpinnings. However, there is accumulating evidence that challenges this distinction. Therefore, in three studies we experimentally tested potential interactions between fear (acute threat) and anxiety (potential threat) using a cue-in-context conditioning paradigm to test the impact of contextual threat on defensive responses to acute threat. In total, 141 participants completed a differential fear conditioning paradigm followed by a cue-in-context test phase in which the fear-conditioned cues were presented orthogonally either in front of inherently or conditioned aversive vs neutral contexts. Subjective, physiological (electrodermal and cardiovascular), and electrocortical measures (steady-state visual evoked potentials, ssVEPs) of defensive responding to the conditioned stimuli as a function of contextual threat were obtained. Results demonstrated successful fear conditioning in all measures. In addition, threat

and US- expectancy ratings, cardiac deceleration, skin conductance, and ssVEP responses were enhanced to conditioned cues presented in aversive compared to neutral contexts. This effect was more pronounced for inherently aversive compared to conditioned contextual stimuli. These results are in line with the notion that defensive responses to potential and acute threat, hence anxiety and fear, are not mutual exclusive but interact to optimize adaptive behavior in life-threatening situations.

Talk 4 - Manon Mulckhuysse

The role of the right Angular Gyrus in orienting and re-orienting of attention towards Threat

Reorientation of attention to threatening stimuli is a fundamental part of human cognition. Such interaction between cognitive and affective processes is often associated with faster responses. In the present study the role of the right angular gyrus (AG) in reorienting to threat is examined. An exogenous spatial cueing paradigm was adopted with threatening and non-threatening targets. Threat was induced by means of differential fear conditioning of the target. Single pulse transcranial magnetic stimulation (TMS) was applied to the right AG at different stimulus onset asynchronies (SOA) after target onset (range 30ms -300ms). TMS was predicted to interfere at an earlier SOA with reorienting (during invalidly cued trials) to threatening targets. Even though an overall decrement in performance to targets contralateral to TMS stimulation was found, TMS to right AG did not specifically affect reorienting, neither to safe nor to threatening targets. We suggest that detection of biologically significant stimuli outside the focus of attention may depend more on the ventral frontoparietal rather than dorsal frontoparietal network of attention.

Talk 5 - Gilles Pourtois

Modulation of spatial orienting towards fear depending on goal relevance's content

Although threat-related stimuli can capture attention automatically, recent findings and theoretical models assume that this capture is not automatic because it can be modulated by goal relevance of emotion. In a series of three behavioral experiments (N=40 participants each time) and an EEG one (N=37), we used a standard dot probe task in combination with induction trials to make emotion goal relevant. Results showed that in the absence of induction trials, fear captured attention automatically during the dot probe task, as revealed by faster reactions times (RTs) for fear valid than fear invalid trials. When induction trials were used, the modulation of this capture actually depended on whether basic or superordinate emotion processing was required. When superordinate emotion processing was used (i.e. to discriminate emotion from neutral stimuli), fear continued to capture attention automatically. However, when basic emotion processing was required (i.e. to discriminate fear from happiness), fear ceased to capture attention. At the EEG level, we found that the use of basic emotion processing during induction trials led to amplitude modulations of specific cue- (i.e. N170 component) as well as target-related ERP activities (i.e. N1pc) recording during the dot probe task. These results suggest that goal relevance can influence emotional attention, yet this modulation depends on how specific emotion is

in terms of goal. These results are discussed against contemporary models of attention where multiple sources of information, including goal and value, can synergistically combine with each other and eventually contribute to target's selection.

*Location: Leslokaal 1.2
symposium 28*

Navigating psychosocial stress: understanding its impact and exploring possible pathways to well-being

Vanessa Era, Giorgia Silani, Chiara Fini, Nicole Rheinheimer

This symposium explores the intricate relationship between psycho-social stressors and well-being. The first presentation discusses the use of ingestible pills to directly assess gastrointestinal markers of psycho-social stress. The second delves into the impact of experimentally induced social deprivation on psychophysiological well-being, drawing parallels with food deprivation. The third examines the influence of mental stress on social connection, while the fourth scrutinizes stress recovery in infants during walks in natural environments. Together, these contributions deepen our understanding of stress consequences on human deep bodily physiology and social connection, while also uncovering pathways for stress alleviation to promote overall well-being.

Talk 1 - Vanessa Era, Giuseppina Porciello, Arianna Vecchio, Sofia Ciccarone, Quentin Moreau, Maria Serena Panasiti & Salvatore Maria Aglioti

Ingestible pills reveal changes of gastric activity associated to psycho-social, virtual-reality induced, stress

Stressful situations elicit a cascade of psychophysiological responses, involving changes in various systems such as the hypothalamic-pituitary-adrenal axis, the autonomic nervous system, and the enteric nervous system. Social, psychological or physical stressors have detrimental effects on both physical and mental health. While it is a common experience that stress is accompanied by intense gastrointestinal (GI) sensations, objective evidence demonstrating the impact of stress on enteric functions has been constrained by the reliance on indirect measures of gastric activity. This gap in knowledge is primarily due to challenges in monitoring GI activity, which traditionally relies on invasive and expensive methods. A promising solution comes in the form of ingestible pills (IP), which offer a non-invasive and minimally intrusive means of obtaining direct indices of GI physiology. These sensors-equipped biocompatible capsules enable a comprehensive evaluation of pH, pressure, and temperature along the GI tract. In the current study, we exposed a group of healthy individuals (N = 20) to immersive virtual reality, with a set of validated, psycho-socially stressful, highly immersive scenarios, in conjunction with IPs to explore GI markers of stress-related responses. Preliminary findings suggest a trend towards increased acidity in gastric pH during psycho-socially stressful scenarios compared to non-stressful, control scenarios. This innovative approach holds significant promise for advancing research on the physiology of stress-related responses, providing crucial insights for the prevention and diagnosis of GI conditions associated with stress, including anxiety, depression and functional gastrointestinal disorders.

Talk 2 - Ana Stijovic, Paul A. G. Forbes, Livia Tomova, Nadine Skoluda, Anja C. Feneberg, Giulio Piperno, Ekaterina Pronizius, Urs M. Nater, Claus Lamm, Giorgia Silani

Disrupted social homeostasis? Effects of acute social isolation on energy and fatigue: evidence from the lab and the field

Social contact is a fundamental need of social mammals, and long-term social isolation predicts aversive health outcomes. However, human adaptive responses to short-term social isolation are less understood. In this talk I will present findings pertaining to the effects of experimentally induced acute social isolation on psychological and physiological measures in humans, and compare them to the effects of a better-known deprived state such as fasting. Furthermore, in order to test their ecological validity, a subsample of individuals, participating in a large-scale EMA study during the first COVID-19 lockdown and undergoing days of social isolation, was examined on the same self-report measures collected in the lab. Experimental induction of social isolation resulted in higher need for social contact, lower energetic arousal and higher fatigue, as well as higher desire to avoid the situation, to a similar extent to increased desire for food, fatigue and low energy during food deprivation. Notably, the change in energy after social isolation observed in the lab was replicated in the field study. Here, I propose that lowered energy could be part of a 'social homeostatic' response to isolation, which may share similarities with other homeostatic systems, such as the regulation of food intake.

Talk 3 - Chiara Fini, Martina Fusaro, Cristina Ottaviani & Vanessa Era

How intrusive thoughts modulate the predisposition to social interaction

Depressive symptoms are associated with social isolation. In this study, we examined whether intrusive thoughts, typical of depressive symptomatology, also impact the predisposition to socially interact. This predisposition was investigated through measures of interpersonal distance and psychological closeness. Thirty participants were asked to introduce themselves to a same-gender confederate by writing a few sentences on an online chat platform. In the experimental session, they were instructed to think about personal anxiety-provoking past or future events (inducing intrusive thoughts), while in the control session, they were asked to think about a dramatically read or watched story. Additionally, participants completed questionnaires on depression, loneliness, and rumination. Results indicate that: i) intrusive thoughts increased interpersonal distance as depressive symptoms became more prominent, ii) at higher levels of perceived loneliness, interpersonal distance also increased, iii) when inducing intrusive thoughts, higher levels of rumination were associated with more extended interpersonal distance, and iv) when inducing intrusive thoughts, a higher predisposition to intrusive thinking was linked to increased interpersonal distance. Thus, intrusive thoughts appear to have a significant impact on the social sphere. Given that reduced social interactions have been consistently associated with detrimental effects on psychophysical health, our study underscores the importance of understanding the intricate interplay between depressive symptoms, intrusive thoughts, and social predispositions for overall well-being.

Talk 4 - Nicole Rheinheimer, Stefania V. Vacaru, Simone Kühn & Carolina de Weerth

Does a walk in the forest reduce stress in infants?

The increase of infants' cortisol levels in response to a stressor has been studied extensively. There is a lack of research, however, on infants' recovery of cortisol levels back to baseline. Cortisol recovery is crucial during early life, since chronically elevated cortisol levels have been shown to negatively impact physiological and psychological development. While a vast body of research has demonstrated that spending time in outdoor green environments decreases cortisol levels and improves mental wellbeing in adults, this has never been assessed during infancy. Furthermore, there is a lack of studies assessing whether using an infant chest carrier can additionally decrease distress. In this randomized-controlled trial, we studied whether a mother-infant walk in the forest, as well as infant carrying, affect physiological (salivary cortisol recovery) and behavioral (observed sleep) measures. After exposing their infant to a laboratory stressor, mother-infant dyads (N=100) were randomly assigned to one of the four conditions: a) walking in a forest environment with a pram or b) with an infant chest carrier, or c) staying indoors with the infant in a pram or d) being carried and held. Preliminary analyses indicate a higher decrease of cortisol levels when infants were carried, as opposed to being in a pram, regardless of the location. Furthermore, infants slept significantly more during the walk, as compared to infants staying indoors. Current findings deliver novel insights on the stress-reducing effects of outdoor walking and infant carrying, and are relevant for urban-planning, perinatal healthcare, as well as policies regarding maternity leave.

Friday, May 24th 2024 // 5:00pm - 6:30pm

*Location: Leslokaal 1.3
symposium 29*

Touching perspectives: A multidisciplinary exploration of vicarious touch and social interaction across diverse populations and techniques

Martina Fusaro, Matteo Lisi, Sophie Smit, Haemy Lee Masson

The symposium explores the significance of vicarious touch, spanning diverse research across disciplines and populations. The first presentation investigates neural patterns in experimental and mirror-touch synesthetes. The second examines atypical touch observation in autistic individuals, revealing network-level connectivity. The third uncovers the link between negative emotions, vicarious touch and depersonalization. The fourth explores virtual reality's potential to induce vicarious touch and its impact on perceptions of virtual agents. The last presentation introduces the phantom touch illusion in virtual reality and its link with body schema. This symposium weaves rich insights, enhancing our understanding of touch observation and its diverse manifestations.

Talk 1 - Sophie Smit, Denise Moerel, Nora Holmes, Regine Zopf & Anina N. Rich

Overlapping touch representations as a neural mechanism of vicarious touch and mirror-touch synaesthesia.

For some people, vicarious touch arises only in experimental settings such as when watching touch-videos, while others experience this in everyday life, a condition termed mirror-touch synaesthesia. According to simulation theories, vicarious touch involves overlapping neural representations between seeing touch and experiencing touch first-hand. Our research sought to explore such overlap in three groups: those without vicarious touch, individuals who report vicarious touch in experimental settings, and mirror-touch synaesthetes. We employed time-resolved decoding of EEG data, gathered as participants either felt touch on their little finger or thumb or viewed videos showing similar touch being applied to another person's fingers. We found that only in the vicarious touch and mirror-touch synaesthesia group could a classifier, trained on tactile data, predict the location of touch (little finger or thumb) based on visual data. For the vicarious touch group, the neural patterns evoked when observing an approaching touch in the videos overlapped with those that emerged at least 400ms after direct touch. For mirror-touch synaesthetes, the neural patterns evoked throughout most of the video trial overlapped with those present during an earlier stage after direct touch compared to the vicarious touch group. This suggests that in the vicarious touch group, observing touch evokes a more abstracted representation of direct touch, whereas in mirror-touch synaesthetes, this may result in a more sensory touch representation that is sustained for longer. Therefore, consistent with simulation theories, the presence and timing of neural overlap between seeing and feeling touch might explain differences in vicarious touch experiences.

Talk 2 - Haemy Lee Masson

Atypical functional connectivity between the sensorimotor and salience networks during social vs. nonsocial touch observation in autism spectrum condition.

Autistic adults experience difficulties in recognizing social-emotional cues during social interactions. In the context of social touch, brain imaging studies have shown that these challenges are linked to atypical somatosensory responses to affective cues displayed in touch gestures (Lee Masson et al., 2019). It remains unclear, however, whether the atypicality during touch observation is confined within a single brain region or manifests in network-level communication. Forty-two men watched social and nonsocial touch videos during MRI scans in the previous study (Lee Masson et al., 2019). Independent component analysis and temporal sorting methods applied to this dataset yielded ten task-relevant brain networks, including the visual, sensorimotor, salience, social perceptual, and default mode networks. A generalized psychophysiological interaction (gPPI) analysis was applied to these networks to examine changes in functional connectivity between social and nonsocial touch. A mixed model ANOVA on gPPI results revealed a significant group x condition interaction in the strength of functional connectivity between the sensorimotor and salience networks. In neurotypical adults, this network pair showed enhanced functional synchronization for social touch, whereas enhanced functional synchronization was observed in autistic adults for nonsocial touch. No other network pairs showed significant differences in the connectivity strength between the two groups. The current findings suggest that, even though autistic adults exhibit a comparable functional network architecture during touch observation, the atypical communication patterns between the sensorimotor and salience networks may be associated with the inefficient use of affective touch as a communicative tool during social interactions.

Talk 3 - Helge Gillmeister

Measuring vicarious touch to probe bodily sense of self in people with and without symptoms of depersonalisation.

Electrophysiological studies can reveal the cortical dynamics of atypical perceptual and cognitive processes during touch observation. Here, I present a series of EEG/ERP studies investigating mechanisms of bodily resonance (vicarious touch) and emotional priming in individuals with and without symptoms of depersonalisation (DP). Study1 shows reduced vicarious touch for the self-face at early perceptual stages (somatosensory-P45 component) in individuals with high vs. low-DP and reduced self-other differentiation at late cognitive stages (200-300 ms). Study2 presents further evidence for aberrant bodily resonance, and shows reduced processing of emotional face-voice stimuli, as well as interactions between these processes. Weaker differentiation for angry vs. neutral face-voice stimuli (visual-N170 component) in the high- than the low-DP group systematically related to self-reported bodily symptoms like disembodiment. Critically, in the high-DP group, early perceptual effects of vicarious touch (somatosensory-P45/P100) occurred only after being confronted with angry face-voice primes. Vicarious touch in the low-DP group, however, was unaffected by preceding emotions, indicating its robust and automatic nature. Modulation of vicarious touch following confrontation with angry others was systematically related to

symptoms of self-other confusion. Our results suggest that others' negative emotions affect somatosensory resonance in those with a weaker sense of bodily-self. These findings are in line with the idea that disconnecting from one's body and self (core symptom of depersonalisation) may be a defence mechanism to protect from the threat of negative feelings, which may be exacerbated through self-other confusion. In addition, our studies showcase the utility of vicarious touch paradigms for investigating the bodily-self mechanisms .

Talk 4 - Matteo Lisi & Martina Fusaro

Shaping Social Interactions in Immersive Virtual Reality: The Impact of Vicarious Somatosensation on Virtual Agent Evaluation and Engagement.

Previous research has demonstrated that Immersive Virtual Reality (IVR) can induce a feeling of ownership over a humanoid avatar observed from a first-person perspective. Furthermore, the mere observation of a syringe or a caress delivered to the embodied virtual body can trigger derivative feelings of pain and pleasure, respectively. Nevertheless, it is unclear how the type and strength of vicarious somatosensation experienced on the virtual body can shape the attitudes towards virtual agents and affect subsequent social interactions. 40 neurotypical individuals observed virtual agents delivering either a stab or a caress on their own embodied avatar's right hand. We assessed the pre-post changes on 1) explicit judgments of the virtual agent's trustworthiness and attractiveness 2) implicit evaluation of the virtual agent's facial attractiveness using a mouse-tracking procedure and 3) physiology and gaze during interpersonal distance regulation. Results indicate that a virtual caress, compared to a virtual stab, significantly induces an improvement in the explicit and implicit evaluation of the virtual agent and a reduction of physiological arousal during the agent's approach. Crucially, perceived (un)pleasantness of vicarious stimuli predicted the improvement in the agent's evaluation. More broadly, this study suggests that the quality of the merely observed somatosensory interactions on one's embodied avatar can affect subsequent social interactions with virtual agents. These findings might be relevant for understanding the psychological effects of embodied interactions in IVR and pave the way for studying vicarious somatosensation in naturalistic and immersive environments.

Talk 5 - Artur Pilacinski, Marita Metzler & Christian Klaes

Phantom touch illusion: studying tactile predictions in virtual reality.

You can't tickle yourself. If you try sliding a finger along your forearm, the tickle sensation will be much weaker than if there was an insect crawling down your skin. This is because the nervous system suppresses the predicted sensory input caused by your own movements. But what happens with this tactile suppression if there is no afferent tactile signal? Recently, we tested this using an immersive virtual reality (VR) scenario in which subjects touched their body using a virtual object. This touch resulted in a tingling sensation corresponding to the location touched on the virtual body. We called it a phantom touch illusion (PTI). Interestingly, the illusion was also present when subjects touched invisible (inferred) parts of their limb. We reason that PTI results from

the tactile suppression process during self-touch. The presence of PTI when touching invisible body parts suggests that tactile suppression is not exclusively based on vision, but rather involves the body schema. It remains to be determined what cognitive components modulate the subjective PTI reports. Phantom touch provides a novel paradigm for studying touch predictions and their subjective and objective components.

Friday, May 24th 2024 // 5:00pm - 6:30pm

*Location: Leslokaal 3.2
symposium 30*

New trends in political neuroscience

Yoni (Jonathan) Levy

Despite the strong appeal of politics in our daily lives, it comes as a surprise that the neuroscience of politics has received very little empirical attention until recently. This is particularly valid given the tight intuitive relationship between our political emotions and attitudes and the brain which orchestrates them. In this symposium, five talks will elaborate on the neural substrates, systems and mechanisms involved in politics; in particular, the talks will target ideological (a)symmetry, polarization, group-identity, interoception, ideological beliefs and susceptibility to propaganda.

Talk 1 - Manos Tsakiris

Feeling our way through politics : is there a role for interoception?

While the broader literature on the role of emotions for political ideology and behaviour is vast, empirical research on the potential role of interoceptive dimensions is scarce. Mapping political emotions to bodily states may help us understand how physiological states, coupled with individual differences in political attitudes, might predispose some people to experience different emotions in a given sociopolitical context. We will present recent studies that attempted to fill this gap by exploring how different interoceptive dimensions link to political ideology. We find some associations between measures of interoceptive accuracy and political ideology whereby higher interoceptive accuracy correlates weakly with greater political liberalism (versus conservatism). This pattern may reflect ideological differences in empathic concern with inter-individual differences in interoception as a common underlying factor. In addition, we investigate whether interoception affects the impact that engagement with politics may have on people's health. The findings suggest that greater interoceptive awareness may limit the negative effects of political engagement on people's health. Looking at the specific ways in which human physiology interacts with contemporary politics and studying the effect of politics on the physiology and experience of one's body and vice versa might help to account for the affective politics of different social groups, in different political and cultural contexts.

Talk 2 - Laura Cram

Partisan Social Cognition and Biased Experiences in a Polarised World: the neural processing of identity-based group membership.

Though partisan selective information consumption and re-evaluation of information are firmly established phenomena, less is known about how partisan identity dynamics

affect in-the-moment experiences that could be differently interpreted. We help address this by using fMRI to probe neural networks involved in processing identity-related behaviour in an experimental design that controls the objective qualities of participants' experiences in a ball passing game while manipulating the identity of interaction partners who generate this behaviour. We find that participants' experiences of in-the-moment interactions exhibit differential neural network involvement depending on the identity of their interaction partners, and this predicted subsequent evaluations of those interactions that were biased in a polarised way. Our results offer valuable evidence regarding interactions between social identity dynamics and political behaviour. We discuss practical implications regarding mitigating group-based polarisation via group perception-correction interventions. Such approaches are sometimes ineffective, even producing a 'backfire effect'. We provide a critical missing piece in this puzzle - biases in the neural processing of in-the-moment experiences driving polarised perceptions may help explain why exhortations to multi-partisan cooperation and dialogue so often fail.

Talk 3 - Dezső Németh

Competing neurocognitive processes underlying the formation of ideological beliefs and susceptibility to propaganda.

History illustrates that economic crises and other socio-political threats often lead to a rise of polarization and radicalism, whereby people become more susceptible to intolerant political messages, including propaganda and populist rhetoric. Political science, sociology, economics, and psychology have explored many dimensions of this phenomenon, yet a critical piece of the puzzle is still missing: what cognitive and neural mechanisms in the brain mediate between these threats and responsiveness to political messages? To answer this question, here, we present a theory that combines cognitive neuroscience theories, namely stress-induced memory shift and competitive cognitive processes, with political science. Our Threat-based Neural Switch Theory posits that the processing of political information, similarly to other information processing, is shaped by the competitive interaction between goal-directed and habitual processes. Threats, also encompassing resource overload, can shift neural networks towards receptiveness to oversimplified political messages. This theory sets out a research program aimed at discovering the cognitive and neural underpinning of how situational factors alter brain functions and modify political information processing.

Talk 4 - Frederic Hopp

Neural Polarisation in the Moral Brain.

Contemporary western societies face many polarizing issues, from COVID-19 and climate change to immigration. These sociopolitical topics are increasingly discussed using moral rhetoric. As moralization of public discourse generates various hallmarks of societal polarization, understanding how the brain represents and organizes moral information alongside politically relevant actors and events is critical. In this talk, I discuss how recent techniques from neuroimaging lend themselves to examine neural

substrates and patterns of politically polarized perception. The challenges and opportunities that naturalistic moral stimuli offer over controlled moral judgment tasks are reviewed in light of their potential to reveal how individual differences modulate polarized neural responses.

Talk 5 - Annika Kluge

Ideological (a)symmetries in neural political polarization.

While some studies show ideological asymmetry in outgroup bias between rightists and leftists, those studies often target an ideologically biased outgroup. Here, we bypass this issue by targeting the ideological outgroups (rightists for leftists, and leftists for rightists). We rely on a magnetoencephalography-based approach delineating function-specific neural mechanisms to test for ideological asymmetries at multiple levels: explicit psychological self-reports, implicit behavioral bias, and neural oscillations. Using a computational model balancing the stimuli and screening rightists and leftist Israeli individuals ($N_1 = 81$), we find ideological asymmetry with rightists being more biased at all three levels. Furthermore, the neural results add important insights by uncovering two underlying mechanisms: the first (late beta-band motor activity) strongly associated with implicit behavior, while the second (early alpha-band dorsal anterior cingulate activity) revealed an anti-leftist bias for both groups. Moreover, in another study that examined ideologically-neutral outgroup bias (towards vaccine-hesitant individuals), rightists and leftist Finnish individuals ($N_2 = 121$) showed symmetry in neural bias, thereby suggesting a particular bias in political polarization. Finally, another study that examined a polarization targeted intervention ($N_3 = 63$) found ideological asymmetry in the impact of the intervention on neural polarization. We discuss implications of the findings on bias, ideological asymmetry, their neural underpinnings, and social norms.



May 25th – 9:00AM – 10:00AM

KEYNOTE LECTURE

Saturday, May 25th 2024 // 9:00am - 10:00am

Location: Auditorium 2

Keynote lecture 3

Embodied morality: influence of exteroceptive and interoceptive bodily cues on moral decisions in real and virtual interactions

Salvatore M. Aglioti

Sapienza University of Rome and cln2s@sapienza, Istituto Italiano di Tecnologia, Italy; Fondazione Santa Lucia, IRCCS

Embodied cognition theories posit that even seemingly abstract processes such as language syntax may be biased by the sensorimotor signals through which bodily self-consciousness - our sense of owning a body (ownership) and being the author of actions (agency)- is built and maintained. Adopting an embodied morality framework, I will focus on our recent research based on innovative technologies (e.g., ingestible devices that can transmit guts signals during cognitive and emotional tasks) and established experimental paradigms (e.g., physiological recording of autonomic nervous activity) and aimed at testing whether strengthening or weakening participants' sense of ownership and agency over artificial agents influence dishonesty in real and virtual interactions. This approach offers insights into

how body-related variables influence moral decisions at behavioral, physiological, and neural levels.

Specifically, I will discuss the impact of exteroceptive (e.g., the external features of a virtual body such as its physical appearance) and interoceptive cues (e.g., the internal bodily states shaped by cardiac, or thermal signals) on modulating bodily-self consciousness and its relation with (dis)honest decisions.

Additionally, I will examine the contribution of less explored, deep body signals (e.g. respiratory and gastro-intestinal) supposedly involved in homeostatic regulation and allostatic brain-body interactions and how these seemingly low- level variables modulate higher-order functions like corporeal awareness, complex emotions and moral decision making.



May 24th – 10:30am – 12:00am

SYMPOSIA & ORAL TALKS

Location: Auditorium 2
Symposium 31

Social and bodily foundations of the self

Rebecca Boehme, Trinh Nguyen, Jane Aspell, Anna Ciaunica

The self is a multifaceted and multilayered construct. The bodily self forms the basis for higher order aspects of the self, like the narrative or reflective self. The bodily self begins to form already prenatally through sensory interactions with the environment and with other human beings. In this symposium, we are bringing together researchers who investigate both bodily and social contributions to the sense of self using a variety of methods and studying different populations. We will address developmental aspects, neurotypical and neurodiverse populations, and philosophical considerations.

Talk 1 - Rebecca Boehme

Experiencing the Self through Others

Interpersonal touch is considered to be especially interwoven with the self in a social context: the first experiences of bodily self-boundaries and of the presence of others arise in early life through both self-touch and caressing touch by the caregivers. Throughout our lifetime, social touch plays a foundational role for both our bodily self and our interaction with others. In this talk, I will address the neurobiological basis of touch processing, explain its developmental and psychological relevance for the sense of self, and discuss examples of altered touch processing in psychiatric populations and during a pharmacological intervention.

Talk 2 - Trinh Nguyen

Sing to me, baby: Infants show neural tracking and rhythmic movements to live and dynamic maternal singing

Maternal singing is a universal form of communication believed to facilitate the mother-infant bond and promote infant development. Maternal songs are mostly performed in two different styles, namely playsong and lullaby (Rock et al., 1999). While it is suggested that playsongs and lullabies have distinct communicative functions for caregiving, we still understand little about how infants neurally and behaviorally respond to live maternal performances of playsongs and lullabies.

The present study investigated the neural and movement responses of 7-month-old infants to maternal singing and how it relates to their linguistic development. The study involved 70 mother-infant pairs who participated in two singing conditions: playsong and lullaby. In Study 1, we used EEG to measure neural tracking in 30 infants, while in Study 2, we coded infant rhythmic movements during the mother's singing in another 40 infants. The children's vocabulary was assessed when they were 20 months old.

The results of Study 1 showed that infants exhibited above-threshold neural tracking of maternal singing, with better tracking of lullabies than playsongs. The acoustic features

of infant-directed singing also influenced tracking. In Study 2, infants showed more rhythmic movement to playsongs than lullabies. Importantly, neural coordination and rhythmic movement to playsongs were positively related to infants' expressive vocabulary at 20 months.

These findings suggest that infants' brain and movement coordination with their caregiver's musical presentations, especially playsongs, may be important for their linguistic development. Overall, the findings provide insights into the potential mechanisms that underlie the early development of language and communication.

Talk 3 - Jane Aspell

The Bodily self in Pain: Investigating the role of Interoceptive Processing

Previous research suggests that the processing of internal body sensations (interoception) affects how we experience pain. Some evidence suggests that people with fibromyalgia syndrome (FMS) – a condition characterised by chronic pain and fatigue – may have altered interoceptive processing, but findings to date have been mixed.

In a first study, we examined interoception in an online study with adults with FMS (N = 154) and an age- and gender-matched pain free group (N = 94) using a heartbeat detection task (the Phase Adjustment Task; PAT), completed remotely via a smartphone application. We found that the FMS sample had significantly higher scores on the heartbeat detection task and had significantly higher self-reported interoception. Within the FMS sample, participants classified as 'interoceptive' on the heartbeat detection task (PAT) had significantly lower symptom impact than unclassified participants. Conversely, self-reported interoception was positively correlated with FMS symptom severity and impact.

The aim of our second (lab-based) study was to identify the optimal duration for an interoceptive (cardio-visual) full body illusion intervention (Aspell et al., 2013), that is balanced in terms of tolerability and benefit (reduction in pain). We are using a dose escalation/de-escalation paradigm (e.g., Colluci et al., 2017). Preliminary findings (n=13) indicate that a dose (duration) of ~20 minutes is optimal in this cohort.

The present findings suggest that interoception and more broadly, the multisensory representation of the body, are important factors to consider in understanding chronic pain.

Talk 4 - Anna Ciaunica

The First Senses - The Co-Embodied Roots of Bodily Self-Consciousness in Early Life

Bodily self-self-awareness – the fundamental subjective experience of being an embodied 'I', distinct yet related to the world and others – has been typically addressed from an adult-centric perspective both in philosophy and cognitive science. Yet, like all living biological systems, human bodies develop : they are gestated, born, grow, decay, and eventually die. This paper argues that in order to understand bodily self-awareness, one needs to first address how it dynamically develops from 'square one' in utero and early infancy.

I will focus on one fundamental yet overlooked aspect of current discussions is that the closest and most primitive environment of a human body is another human body. Crucially, while not all humans will have the experience of being pregnant, the experience of developing within and in close contact another person's body is universal.

I will show how the 'first senses', i.e. primordial sensory processing such as touch and olfaction, progressively unfolds and scaffolds self-perception and bodily self-consciousness in early life in humans. I will discuss theoretical and empirical work on how the early senses develop and contribute to building human bodily self-consciousness in utero and beyond in the postnatal period. I will provide a comprehensive integrative picture of existing methods and findings tackling this fundamental yet overlooked question of co-embodiment in early life. I will conclude that examining bodily self-consciousness in isolation from its developmental roots may prevent us to capture aspects of perception and self-consciousness in adults.

Talk 5 - Shir Atzil

The allostatic roots of social bonding

Optimizing allostasis is a unifying principle that motivates and shapes social bonding across the lifespan in social species. Accordingly, the neural circuits that support social bonding overlap with the neural circuitry for allostasis. The "social brain" is often considered a specialized brain system. An alternative view suggests that social stimuli do not have unique value, but rather, have value because they help social animals regulate their metabolic state. If this is the case, then a domain-general brain system that optimizes allostasis may subserve the processing of both social and non-social affective information. I will present theoretical and empirical accounts to map the neural reference space for social processing and propose that social brain processing relies on regions of visceromotor control, abstraction and prediction.

*Location: Auditorium 4
Symposium 32*

Understanding persuasive communication using brain responses

Belina Rodrigues, Christin Scholz, Hang-Yee Chan, Leo van Brussel

Effective communication can educate consumers, improve their habits, and promote healthier lifestyles. However, crafting persuasive messages is not an easy task. This symposium shows how neuroscience contributes to better understanding whether, why and how different types of communication persuade. We leverage fMRI measures of the brain to demonstrate how craving for unhealthy food decreases after motivational interviewing, how contradictory social media statements on alcohol consumption are processed, whether source bias affects processing of dietary statements, and why storytelling video advertisements are more persuasive. Our results reveal crucial roles for valuation and mentalizing.

Talk 1 - Belina Rodrigues

How patient's words change the rewarding value of food: Mapping the neurocognitive shift generated by Motivational interviewing

Changing one's eating habits is challenging. Motivational interviewing (MI) has been proposed as a communication-based approach to overcome this challenge. MI is a collaborative clinical method, a goal-oriented style of communication focusing on the language of change. It aims to strengthen motivation and commitment to a specific goal by eliciting personal statements for change, i.e. change talk, and handling reasons against change, i.e., sustain talk. We tested how change and sustain talk suggestions, elicited by MI, influenced value-based dietary decision-making and responses of a recently developed neurobiological craving signature (NCS) in female adults. Participants were invited to take part in two visits one-week apart: visit 1 to undergo a one-hour MI session which was recorded and from which five change and sustain talk statements were selected; and visit 2 to undergo the fMRI session. We found that following change talk, compared to sustain talk, participants' food choices and activity in the ventromedial prefrontal cortex were more driven by the healthiness and less by the tastiness of food. These findings were paralleled by lower NCS responses to tasty food after change compared to sustain talk. Additionally, following change talk, participants' body mass indices moderated the NCS decoding of healthy and tasty food choices. These results show that MI leads to a neurocognitive shift in value-based decision-making and reduce craving-related brain marker responses to highly palatable food items. The findings contribute to a better understanding of how communication-based interventions can facilitate healthier eating.

Talk 2 - Christin Scholz

The social life of persuasive messages: How we make decisions in the context of contradictory information from peers and professionals

Like most daily decisions, alcohol consumption has pros and cons. It is a social catalyst, associated with status and fun, but also a serious cause of injury, disease, and death. In line with this ambiguity, diverse stakeholders (e.g. alcohol brands, party-loving friends, health authorities and concerned family) seek to influence alcohol consumption. Their voices create rich information environments with competing alcohol-related messages. How do we integrate competing information during decision-making?

Behavioral work shows effects of competing messages related to the same behavior interfere with each other. For instance, conversations about media campaigns can cause unexpected boomerang effects. This interference and the subsequent effects of a given message are difficult to predict, because the underlying integration mechanisms are poorly understood. We studied the neural mechanisms supporting decision-making in competitive information environments (pre-registration: https://osf.io/fn627/?view_only=7c504cf31260422388b11d5ece8d76b7).

Methods. Eighty participants viewed alcohol-related information (3 stance: pro-/anti-alcohol/non-alcoholic x 2 source: professionally-produced/peer-produced; within-subject) while undergoing fMRI (108 trials/person). After viewing each message, participants rated current alcohol craving. In the following month, they further reported daily alcohol consumption.

Results. Results suggest that neural value-related signals (in ventral striatum and ventromedial prefrontal cortex) are useful in quantifying and understanding the integration of competing messages. This neural indicator encoded message type more reliably than self-report, predicted alcohol craving differentially across message types, and encoded context-dependency. Specifically, neural responses to messages were partially dependent on the message type of previous trials.

Outlook. Before the conference, we will examine relationships between this neural indicator and daily alcohol consumption after the experiment.

Talk 3 - , Hang-Yee Chan

An axe to grind? Neural mechanism of implicit source bias on persuasive message processing

Online interactions increasingly contribute to opinion formation. While the study of persuasion has long recognized the source of the message affects its persuasiveness (e.g., perceived bias and trustworthiness of the source), the neural mechanism of such source effect is not well known. In three studies, including a large sample of European adults and a neuroimaging experiment, we tested whether highlighting the stance of a communicator (implicit source bias) would affect the message's persuasiveness.

We first conducted two online studies where participants viewed a series of tweet-like texts that argued in favor or against meat consumption (Study 1: N = 39 students / Study 2: N = 516 adults). In both studies, messages attributed to known-position Twitter handles (e.g., 'Sam the Vegan' versus 'John Smith') were rated less persuasive.

Forty-five university students then participated in the adapted task while undergoing fMRI scanning. The behavioral effect of implicit source bias was replicated. Using Neurosynth association maps as regions of interest, we found tweets with known-position profiles elicited stronger brain activity associated with mentalizing and reasoning, but only mentalizing activity was negatively related to lower ratings of persuasiveness. This study provided evidence how the brain integrates information from message content and message source during persuasion.

Talk 4 - Leo van Brussel

Why do storytelling ads persuade consumers? Evidence from brain responses to video commercials

Storytelling is key to effective marketing communication. The persuasiveness of story ads is often attributed to narrative transportation, which relies on empathy and mental imagery. Here, we investigate brain activity of consumers processing narratives in video advertisements. Measuring brain responses of consumers watching video ads allows us to investigate how consumers respond to narratives, without breaking the spell of the story.

We report an analysis of two independent fMRI datasets, in which a total of 85 participants viewed and rated a total of 55 video ads. Ad liking was quantified by means of participants' star ratings (0-5 stars, half-star increments). Independent coders used a six-item narrative structure coding scale (Escalas et al., 1994) to quantify the degree to which ads contained a narrative. We used multilevel mediation analysis to assess whether and where in the brain activation mediated the effect of narrative structure score on advertisement liking. Finally, we employed an automatic meta-analysis tool for fMRI data (Neurosynth, Yarkoni et al., 2011) to identify the psychological processes that are most associated with our results.

Our results reveal that persuasiveness of narrative video advertisements is primarily driven by mentalizing. We propose that the act of interpreting stories, that is, understanding actor's beliefs and intentions as well as chronology and causality of the story makes consumers like narrative ads better. Conversely, we found a less pronounced role for empathy and emotions. This suggests that cognitive processing of stories in video advertisements is more important for narrative persuasion than affective processing.

*Location: Auditorium 1
Symposium 33*

Understanding persuasive communication using brain responses

Ellen de Bruijn, Franziska Weinmar, Anne Marieke Doornweerd, Erika Comasco

Female sex hormones exert regulatory effects outside the reproductive tract, but how exactly they affect neurocognitive and affective processes has been surprisingly understudied. Especially effects on the brain may influence behavioral, cognitive, affective, and motivational processes. Hence, hormonal fluctuations during puberty, menstrual cycle, hormonal contraception use, pregnancy, and menopausal transition are all critical targets of investigation. In this symposium, latest results from studies focusing on these age-critical periods will be presented along with the outcomes of a recently organized workshop, which was aimed at providing improved harmonization and guidelines for neurocognitive and affective research across the female lifespan.

Talk 1 - Ellen de Bruijn, Anne Marieke Doornweerd, Lotte Gerritsen, Joke Baas, Birgit Derntl

Outcomes of the international expert meeting on the effects of hormonal fluctuations on neurocognitive functioning across the female lifespan

Women experience unrivalled drastic natural changes in sex hormone levels over the lifespan, especially during age-critical transition periods such as puberty, the menstrual cycle, and menopause. Along with the hormonal shifts, these periods are associated with major changes in physical, psychological, and psychosocial factors as well as increased risk of affective, anxiety, and stress-related symptoms. Thus, the effects of these hormonal fluctuations have far-reaching consequences at both an individual and societal level. Despite the widespread variety in the effects of hormonal changes, our understanding of how they together contribute to cognitive and affective functioning and well-being in girls and women at different ages is strikingly little.

To address this pressing gap, we organized an interdisciplinary workshop last February with international experts from psychology, neuroscience, psychiatry, neuroendocrinology, and gynecology. The main aim of this expert meeting was to identify current and future research challenges and opportunities and set up a broad research initiative that will foster collaborative research into the effects of hormonal fluctuations on neurocognitive and affective functioning across the female lifespan.

In my presentation, I will briefly present an overview of the most important outcomes of this workshop as well as future plans to further improve harmonization among disciplines and facilitate international collaborations in this important and emerging research domain.

Talk 2 - Franziska Weinmar, Lydia Kogler, Elisa Rehbein, Carmen Morawetz, Inger Sundström-Poromaa, Alkistis Skalkidou, and Birgit Derntl

Neural emotion regulation during pregnancy – a fMRI study investigating a transdiagnostic mental health factor in healthy first-time pregnant women

Pregnancy is a psycho-neuro-endocrinological transition phase presenting a window of vulnerability for mental health. Emotion regulation, a transdiagnostic factor for psychopathology, is influenced by estradiol. For the first time, behavioral and neural emotion regulation were investigated in healthy pregnant females with extremely high estradiol levels during the second trimester using a functional magnetic resonance imaging (fMRI) paradigm. Results were compared with naturally-cycling females with high and low estradiol levels. All females successfully regulated their emotions and had increased frontal activity during downregulation of negative emotions. While pregnant females showed no differences in functional connectivity, the groups differed on amygdala activation. In pregnant females, increased amygdala activity predicted reduced regulation success and positively associated with depression scores. This first fMRI study during pregnancy indicates that depression scores are reflected in heightened amygdala activity during antepartum, which, together with reduced regulation success, suggests a neural risk marker for peripartum mental health.

Talk 3 - Anne Marieke Doornweerd, Lotte Gerritsen

28 days later – an EMA study of mood and sex hormone dynamics in naturally cycling women

Fluctuations of sex hormones throughout the menstrual cycle are often paralleled by socio-emotional and behavioral changes. However, research on this phenomenon in healthy reproductive women show inconsistent associations of mood with cycle phases and sex hormone levels. Inter- and intra variability of the menstrual cycle introduce methodological difficulties, especially with the majority of studies applying a between subject design or only account for a few menstrual cycle phases. The aim of the current study was to gain a better understanding of the specific contribution of sex hormones to a broad range of cycle-related mood changes. We conducted a 28 day intensive longitudinal study, during which 23 naturally cycling (NC) women filled out daily assessments of mood, stress, irritability and sexual desire. Daily saliva samples were taken that were analyzed for estradiol, progesterone and testosterone levels. 17 oral contraceptive (OC) users were included (with weekly hormone measures) to account for a relatively stable hormonal milieu. Preliminary results indicate reliable hormone levels throughout the 28 days for both NC women and OC users. Results will be presented on direct relationships between sex hormones and mood aspects. Multiple questionnaires will be included to account for differences on baseline mood and possible confounding variables. It will be discussed whether the hormones estradiol, progesterone or testosterone underly changes in mood, stress, irritability and sexual desire in NC women.

Talk 4 - Erika Comasco

The interplay between gonadal hormones and nicotine administration on reward-based decision making

Notwithstanding mounting evidence on the influence of gonadal hormones' fluctuations on the brain's structure and function, the role of gonadal hormones on reward-based decision-making is understudied. Recent evidence suggests that estrogen enhances reactivity to rewarding stimuli while progesterone suppresses estrogen's facilitative effect, resulting in a stronger reaction to rewarding stimuli in women in the follicular phase compared to the luteal phase in the menstrual cycle. On the other hand, nicotine is generally beneficial to attention and working memory in non-smokers and was shown to enhance these cognitive processes in the luteal phase more than in the follicular phase in women. The current single-dose nicotine administration study assessed women's performance on the Iowa Gambling Task, a reward-based decision-making task in which men perform better than women on average. The overarching aims of the current study were to overcome the inconsistent literature on gonadal hormones' influence on this task, the lacking literature on non-chronic use of nicotine and the Iowa Gambling Task, and to assess for the first time possible interactions between the modulating effects of gonadal hormones and nicotine.

Exploring the effects of stress on social decision-making and learning

Paul Forbes, Jonas Nitschke, Luca M. Lüpken, Nace Mikus

Stress results in a complex cascade of physiological and psychological changes, but the consequences these changes have for social decision-making and learning remain unclear. Several recent meta-analyses and replication attempts have highlighted the inconsistent nature of stress effects on cognition and behaviour. In this symposium, we will explore when, if and how various types of stress can influence social decision-making and learning. The symposium will cover a range of tasks, from moral judgement to reinforcement learning to computational modelling of behaviour, as well as a range of stressors ranging from psychopharmacological stressors to acute stress induction to lifetime stress-exposure.

Talk 1 - Luca M. Lüpken

The Mystery of Stress Neuromodulators: Exploring Their Effects on Diverse Social Behaviours

Stress is an inherent aspect of human life that is intertwined with daily social interactions. Yet, the precise effect of stress on social perception and interaction and the direction of these effects remain elusive – particularly regarding stress neuromodulators. To understand these complex dynamics, we investigated the effect of two prominent stress neuromodulators, cortisol and noradrenaline, on a range of social behaviours: economic decision-making, moral judgement, implicit biases, and group dynamics. We expected discernible effects of these neuromodulators on both social perception and social decision-making. In two studies, we used a psychopharmacological approach and randomly assigned participants to one of four experimental conditions. Participants received either a drug which increased the action of cortisol (hydrocortisone), a drug which increased the action of noradrenaline (yohimbine), both drugs (yohimbine + hydrocortisone), or a placebo. In Study 1, we examined economic decision-making in an adapted dictator game and everyday moral decision-making. In Study 2, we examined implicit biases, in-group and out-group decision-making, and social discounting. Previous research on the effects of stress neuromodulators on social behaviour tentatively suggests that cortisol and noradrenaline modify social behaviour, but the direction and impact on different domains of social perception and behaviour are inconclusive. Our design allowed us to not only establish the direction of these effects but also to demonstrate their extent in different domains of social perception and behaviour. Overall, our findings highlight the heterogeneous and inconsistent effects of stress neuromodulators on social behaviour.

Talk 2 - Paul A. G. Forbes

Acute stress results in fewer optimal decisions during reinforcement learning for social and monetary rewards

Learning which aspects of our environment are most likely to bring rewards is important for survival and well-being. We investigated how this type of learning is affected by acute stress - a common everyday occurrence. Participants (n=96), half of whom were placed under acute psychosocial stress, completed two versions of a two-armed bandit reinforcement learning task. In the money version, participants learned, through their choices, which of two symbols was more likely to bring a monetary reward. In the social version, participants learned which of two people was more likely to bring them a social reward in the form of a 'like' (i.e., positive evaluation) on a previously created social media profile. Overall, stressed participants made fewer optimal decisions during the reinforcement learning tasks. Computational modelling revealed that across both groups, participants were more 'explorative' in the social task and more 'exploitative' in the money task, despite the value of the social and monetary rewards being matched for each participant. Using functional magnetic resonance imaging, we propose that differences in optimality between the stress group and the control group could be linked to changes in the brain's valuation networks. Together, our results provide important insights into how reinforcement learning is affected by acute stress and, more generally, provide a novel paradigm for investigating differences in learning for social and monetary rewards.

Talk 3 - Jonas P. Nitschke

The Association between Lifetime Stress-Exposure and Social Trust Learning

Stress is omnipresent in life, potentially negatively affecting health and well-being. Social connections have been shown to buffer these adverse effects. However, we know little about how the experience of lifetime stress-exposure impacts one's ability to foster and maintain relationships. Here, we investigated the association between life stress and trust formation using a social reinforcement learning paradigm to understand how stress impacts the development of trust. To assess stress levels, we used the STRAIN, a well-validated structured interview, to assess the severity of experienced lifetime stress-exposure in 170 participants. To examine trust learning, we used a repeated-trust-game in which participants had to learn how much they should trust two different trustees over several rounds. After participants had learned these contingencies, the trustee's behaviours changed, allowing us to determine how participants would react to changes in their decision space. We used Bayesian modelling to assess how the updating of beliefs about the trustworthiness of others was affected by stress. We find that lifetime stress-exposure impacted how participants learned about others' intentions in a repeated-trust-game, as indicated by lower mean investments and a higher sensitivity to social feedback, parametrized by the learning-rate. Trust is foundational for the maintenance and facilitation of social connectedness and may have an impact on health and well-being. This highlights that even small transgressions might be more consequential with higher levels of life stress. Our findings show the importance of studying the effects of life stress on basic social mechanisms to understand risk and resilience factors for health.

Talk 4 - Nace Mikus

Neurocomputational involvement of dopamine and opioid receptors in perceived loss of control

Perceived loss of control is experienced as stressful and can drastically impact the ability and motivation to act. Exposure to uncontrollable environments engages the endogenous opioid system and affects dopamine related instrumental learning processes, yet the mechanistic roles of these two neurotransmitter systems in learning about control are not well understood. Here, we conducted a novel task in which participants need to exert effort to either win or avoid losing and then manipulate the degree of control they have over the outcome of each trial. In study 1 ($n = 45$, four testing sessions) we found that that loss of control led to higher self-reported stress ($p < 0.001$, $ICC = 0.81$), with participants high on the Perceived Stress Scale having a stronger negative effect of control on subjective stress ($p < 0.05$). Participants also showed an attribution bias, more likely attributing negative outcomes to luck and positive ones to personal merit ($p < 0.001$, $ICC = 0.87$), which in turn decreased stress sensitivity ($p < 0.001$). In study 2, we administered 50 mg of opioid antagonist naltrexone ($n = 24$), 400 mg of dopamine antagonist amisulpride ($n = 27$) or placebo ($n = 24$) and found that, while neither drug affected perceived stress, both drugs had an effect on learning about control, determined through a Bayesian learning model. With this we provide initial evidence that both dopamine and opioid receptors are involved in estimating the degree to which we have control over our environments.

Saturday, May 25th 2024 // 10:30am - 12:00pm

Location: Leslokaal 1.3

Oral talks 13: Reward processing

Optimistic agents: performing a motor action enhances the neural processing of monetary and social reward

Frederike Beyer

Research has shown that existing pavlovian associations can affect instrumental behaviour and learning. The opposite mechanism – the impact of motor behaviour on pavlovian learning – is rarely studied. Recently, we showed that performing a motor action affects the neural processing of monetary outcomes, specifically enhancing the reward-related positivity as measured using EEG. In a follow-up study, we investigated whether this effect generalizes to social reward processing, and in how far performing an action affects the processing of predictive cues. We developed the Unexpected Visitor Task, in which participants ‘visit’ different houses, to receive either a positive reaction (smile) or a negative reaction (frown) by the person in the house. In active trials, participants were presented with a closed door which they opened by button press. In passive trials, the door was already open, and participants waited to receive the outcome. We found an enhanced feedback-related negativity in active compared to passive trials, which was driven by enhanced reward positivity in active trials with positive outcomes. Further, we found a stronger N2 amplitude for cues predicting negative outcomes, regardless of whether they were associated with active or passive trials, suggesting that participants learned stimulus-outcome associations in both trial types. Overall, our findings suggest that active behaviour – in the absence of instrumental control – enhances the neural processing of reward, which may have important implications for our understanding of anhedonia and addiction.

Location: Leslokaal 1.3

Oral talks 13: Reward processing

Effects of reward on task representations in Anterior Cingulate Cortex

Emmanouela Foinikianaki, Iris Ikink, Ricardo Alejandro, Thomas Colin, Clay Holroyd

Extensive research has been conducted on the neural mechanisms underlying reward modulation of behavior. However, less is known about how these processes affect hierarchically-organized sequential behaviors, wherein low level actions are organized into higher-order goal-directed behavior. According to Holroyd & Yeung (2012), the anterior cingulate cortex (ACC) applies cognitive control over hierarchical task execution and ensures the successful completion of tasks by encoding relevant context via multivariate representations. In our study, we used model-based representational similarity analysis (RSA) to investigate the role of ACC in this, given its involvement in reward processing and in tracking the progression of sequential behaviors. We recorded the event-related functional magnetic resonance imaging (fMRI) response in a modified Coffee-Tea Task, a hierarchical sequence task consisting of 6 decision states and 2 higher-order tasks (i.e., making coffee or tea), by rewarding performance on one of the two tasks (counterbalanced across participants). We hypothesized that the model-based representational dissimilarity matrix (RDM) RSA will load most strongly onto ACC compared to other brain regions and that reward will affect the multivariate activity patterns in ACC, reflecting increased control over task performance. Fifty participants completed the experiment and model-based RSA, computing the cross-validated Euclidean distance, has revealed ACC as the predominant cluster in the brain. Our main conclusions involve that ACC encodes a reward prediction error at the onset of hierarchically organized action sequences and that other brain areas loading onto the model-based RDM show different reward effects.

Location: Leslokaal 1.3

Oral talks 13: Reward processing

Avoiding financial losses improves event-based – but not time-based – prospective memory in healthy older adults

Marta Menendez Granda, Michael Orth, Sebastian Horn, Matthias Kliegel, Jessica Peter

Prospective memory, the ability to remember to do something in the future, can be event-based or time-based. Since older adults learn better by avoiding losses, we tested whether this serves as an incentive for their prospective memory. In addition, we examined the neural substrates of any improvement using ultra-high field fMRI.

We randomly assigned $n = 60$ healthy adults (60-75 years old, 60% female) to an experimental or a control group. The experimental group's initial amount of money was reduced by each missed action in the prospective memory task, either event-based or time-based. Tasks were done using 7T- fMRI and consisted of a preparatory phase until an action was prompted by an event or after 1 minute had elapsed.

In the event-based task, participants became more accurate when avoiding financial losses ($p = 0.012$). This related to higher activity in regions of the default mode network (e.g., precuneus) while expecting the event and to stronger deactivation of occipital areas once the event had prompted action. In the time-based task, participants were not more accurate when avoiding financial losses and they also did not check the clock more often. However, we found higher activity in temporal and frontal-orbital regions when executing the intention. In addition, brain regions important for time monitoring were found more active when avoiding losses.

Avoiding financial losses enhances event-based prospective memory. Switching effectively from the expectation of an event to the action phase may reflect the neuroanatomy of how the brain focuses on the task at hand.

Location: Leslokaal 1.3

Oral talks 13: Reward processing

How distributed subcortical integration of reward and threat may inform subsequent approach-avoidance decisions

Anneloes Hulsman, Felix Klaassen, Linda de Voogd, Karin Roelofs, Floris Klumpers

Healthy and successful living involves carefully navigating rewarding and threatening situations by adopting an appropriate balance between approach and avoidance behaviours. In excessive avoidance, potential rewards are often sacrificed to avoid potential threats. However, little is known about how the processing and integration of reward and threat information in the human brain contribute to approach-avoidance decision-making. In this preregistered study (<https://osf.io/7sm9k>), participants (N=31, 17 females) performed a Fearful Avoidance Task (FAT) in the MRI scanner to assess approach-avoidance decisions under varying reward (monetary gains) and threat (electrical stimulation) prospects.

We hypothesized parallel processing of reward and threat in subcortical regions traditionally associated with either the reward or threat network. However, using Bayesian Multivariate Multilevel (BMM) analyses we found integration of reward and threat in subcortical regions, including the ventral striatum, thalamus, and bed nucleus of the stria terminalis (BNST), prior to indicating approach-avoidance decisions. Importantly, avoidance decisions were preceded by stronger threat-related neural activity in low reward conditions compared to approach decisions. In contrast, during anticipation of the outcome of approach-avoidance decisions, reward and threat expectancies were separately tracked in regions within the reward (ventral striatum, ventromedial prefrontal cortex), threat (BNST), and salience network (dorsal anterior cingulate cortex, thalamus, periaqueductal gray).

In conclusion, the subcortical integration of reward and threat information prior to approach-avoidance decision-making suggests a departure from conventional views that segregate brain regions as either reward-sensitive or threat sensitive and assign the integration of reward and threat to cortical regions.

Location: Leslokaal 1.3

Oral talks 13: Reward processing

Identifying the source of the Reward Positivity using intracranial EEG recorded from epilepsy patients

Joyce Oerlemans, Ricardo Alejandro, Paul Boon, Alfred Meurs, Veerle De Herdt, Clay Holroyd

Background and aims

The Reward Positivity (RewP) is a frontocentral event-related brain potential (ERP) component sensitive to reward processing that emerges approximately 250-350ms after feedback stimuli. Despite widespread interest in the neurocognitive mechanisms underlying this component, the neural source of the RewP remains unknown because of the inverse problem. The aim of this study is to provide direct evidence of the source of the RewP using intracranial EEG data obtained from epilepsy patients.

Methodology and results

Patients with refractory epilepsy scheduled for invasive video-EEG monitoring were recruited at Ghent University Hospital, Belgium. Participants performed the virtual T-maze task (vTMT), a task known to elicit a robust RewP, while scalp and intracranial EEG were simultaneously recorded. The RewP was identified on scalp EEG using ERP-analysis with a standard difference wave approach (i.e. positive vs. negative feedback). Intracranial EEG data were analysed using a similar approach, resulting in average difference waves per intracranial electrode. Six patients had electrodes located over the ACC. Next, we performed a group analysis by combining the intracranial data of all participants together and we created a FEM head model. Current density mapping (CDM) was used to identify the area of highest activity at the peak of the RewP on scalp EEG, and CDMs were compared per region of interest (including rostral and caudal ACC).

Conclusion

The CDM showed highest activity in left caudal ACC at the moment of peak of the RewP on scalp EEG, indicating left caudal ACC as the source of the RewP.

Location: Leslokaal 3.2

Oral talks 14: Imitation & Coordination

Enhancing and decreasing premotor-to-motor connectivity through spike-time-dependent plasticity increases and decreases automatic imitation: a cortico-cortical paired associative TMS study

Sonia Turrini

Introduction: Humans tend to spontaneously mimic others' behavior, even when detrimental to the task at hand. The Action Observation Network (AON) is consistently recruited during imitative tasks, yet whether automatic imitation is mediated by cortico-cortical projections from the AON to the primary motor cortex (M1) remains speculative. Similarly, the potentially dissociable role of AON-to-M1 pathways involving the posterior inferior frontal cortex (pIFC) or supplementary motor area (SMA) in automatic imitation is unclear.

Methods: We used the TMS protocol of cortico-cortical paired associative stimulation (ccPAS) to enhance or hinder connectivity in the pIFC-to-M1 and SMA-to-M1 pathways via Hebbian-like plasticity, and tested their functional relevance through a well-established automatic imitation task.

Results: We found dissociable effects of manipulating the strength of the two pathways. While strengthening pIFC-to-M1 projections enhanced automatic imitation, weakening them hindered it. On the other hand, strengthening SMA-to-M1 projections enhanced imitation control, reducing the automatic imitation tendency. Behavioral changes specifically occurred in conditions of competition between goal-oriented behavior and imitation tendencies.

Conclusion: We demonstrated that driving associative plasticity over AON-to-M1 projections induces opposite effects on automatic imitation that depend on the targeted pathway, thus highlighting the malleability of AON to Hebbian-like associative plasticity. Our study provides unprecedented causal evidence of the functional relevance of pIFC-to-M1 projections to automatic imitation, seemingly involved in spontaneously mirroring observed actions and facilitating the tendency to imitate them. Moreover, our findings support the notion that SMA exerts an opposite gating function, inhibiting the M1 to prevent overt motor behavior when inadequate to the context.

Location: Leslokaal 3.2

Oral talks 14: Imitation & Coordination

Interpersonal coordination without (?) predictive representation of a co-actor's possible reaching directions in a synchronous joint task: An EEG study

Dimitrios Kourtis

We investigated whether people form joint action plans, which include the predictive representation of their own as well as a co-actor's possible reaching directions in a synchronous joint reaching task. An EEG participant and a confederate of the experimenter were seated side by side viewing a computer monitor on which visual stimuli were displayed. Three possible reaching targets were arranged on conceivable semi-circles at the side of each co-actor. An informative cue indicated one, two or three possible reaching targets for each co-actor, followed by an imperative signal, which specified the targets to be reached and prompted the co-actors to initiate their actions in a coordinated manner. We hypothesized that action onsets as well as amplitudes of movement planning (CNV and MRP) and task updating (P300) ERPs would be modulated depending on the number and the spatial configuration of possible reaching targets of each co-actor. Confirming our predictions, behavioural data analysis from 29 participants showed that the participants' action onsets were inversely related to the number of their own as well as their co-actors' possible reaching directions. The EEG analysis showed that the amplitudes of all ERPs of interest were modulated in relation to the participants' possible reaching directions; however, no such modulation was observed in relation to the co-actor's possible reaching directions. Taken together, our results suggest that people adjust their action onsets in relation to both their own and their co-actors' possible reaching directions, but quite likely without the formation of a joint action plan.

Location: Leslokaal 3.2

Oral talks 14: Imitation & Coordination

Neural mechanisms of BeMim: copying of choices leads to liking and temporoparietal brain activity

Paula Wicher

Being mimicked (BeMim), the state of having your actions copied by another person is believed to lead to liking and affiliation. To understand the neural and cognitive mechanisms behind this effect, we used fNIRS to track brain activity in two groups of participants experiencing different types of mimicry. Choice BeMim participants pointed to a painting and then saw a confederate who liked the same/different painting. Motor BeMim participants pointed to a painting and then saw a confederate make the same/different arm movement to another painting. Brain activity in the temporal and parietal cortex was recorded using fNIRS. Behavioural findings demonstrated a robust liking effect for Choice BeMim, proving that mimicking choices yields significant benefits in social perception. This effect was also reflected by the activation patterns within the temporoparietal junction (TPJ) during BeMim trials compared to No-BeMim trials. Additionally, we observed increased activation in the Mirror Neuron system (MNS) during Choice BeMim trials compared to the baseline and Choice No-BeMim trials. These activation patterns suggest that the MNS plays a role in interpreting the decisions of a Choice mimicker across the interaction. Conversely, for Motor BeMim, we identified a subtle behavioural liking effect with no activation in TPJ or MNS. These outcomes suggest that mimicking choices may be a more influential factor in likability judgments than mimicking motor movements.

Location: Leslokaal 3.2

Oral talks 14: Imitation & Coordination

Human-likeness in sensorimotor synchronization parameters facilitates coordination and shared agency perception in HRI

Francesca Ciardo, Davide De Tommaso, Rokas Maksevičius, Peter Keller, Agnieszka Wykowska

Among several mechanisms involved in joint action, we succeed in “staying in the loop” during social interactions thanks to sensorimotor synchronization (SMS), which allows us to develop internal models of both self-and other- actions, and to integrate these models in real-time.

The present study aimed to evaluate whether and how SMS implemented on a humanoid robot can facilitate coordination and shared agency perception in HRI. To this end, we developed a joint tapping task in which participants were asked to play a melody together with the humanoid iCub robot. Across different blocks, we manipulated the amount of temporal error correction applied by the robot to anticipate or adapt to its human partner to resemble or not human parameters. At the end of each block, participants rated the perceived shared agency with the robot. Results showed that better performance, i.e. lower mean asynchrony, and lower variability in asynchrony occurred when the robot acted based human-like parameters of temporal error correction. In addition, shared agency ratings were affected by the human-likeness of the parameters applied to control iCub’s behaviour. Together our results suggest that endowing robots with temporal error correction mechanisms allows humans to successfully stay in-the-loop in HRI, in two different ways. Firstly, the need to constantly update our internal model of the robot to reduce the prediction error about iCub’s performance results in higher synchronization and more strength in coupling when the robot is run based on human-like estimates. Secondly, by increasing the perception of shared agency.

Location: Leslokaal 3.2

Oral talks 14: Imitation & Coordination

Unraveling the Interplay of Interpersonal Synchrony, Social Cohesion, and Performance: The Impact of Social Context

Oded Mayo

Interpersonal synchrony is pervasive in social interactions, influencing group cohesion and performance. However, the intricate relationship between synchrony, cohesion, and performance across diverse contexts remains largely unexplored. Moreover, it has already been suggested that most contexts consist of both tendencies toward synchrony and segregated activity. To bridge this gap, our study employed an innovative paradigm, engaging participants in a computerized dyadic task comprising two simultaneous components: one requiring coordination and the other requiring independent action. This within-subject experiment utilized a 2X2 design (high/low tendencies towards synchrony and segregation).

Outcome measures included electrocardiograms, behavioral synchrony in the task, performance, and self-reports of dyadic cohesion. Our findings revealed that the impact of cohesion varied depending on the context. Cohesion positively correlated with task performance in low segregation contexts but negatively in high segregation contexts. Moreover, we uncovered a mediation effect in which physiological and behavioral synchrony played a crucial role as mediators between cohesion and performance. The link between cohesion and physiological synchrony was context-sensitive, they were positively associated in low segregation contexts but negatively in high segregation contexts. Cohesion was also positively associated with behavioral synchrony, which, negatively impacted performance. Lastly, the effect of behavioral synchrony on performance was moderated by physiological synchrony.

Our study underscores the contextual nuances in understanding the interplay between synchrony, cohesion, and performance. Feeling together and being in sync seems helpful in some contexts but detrimental in others. It also highlights the nuanced interpretation of synchrony across different modalities.



May 25th – 1:00pm – 3:00pm

POSTER SESSION 3

Location: Cafeteria

Poster 1

Structural and functional features separate higher from lower anxious young individuals

Teresa Baggio, Fabrice Crivello, Marc Joliot, Christophe Tzourio, Alessandro Grecucci

Anxiety is a diffuse condition that can range from mild to more severe manifestations, and specific sensitive periods such as adolescence and young adulthood are particularly vulnerable to anxious states. To date, structural and functional research on anxiety has primarily focused on adulthood, employing massive univariate approaches, thus discounting large-scale analyses of the brain organization. Given that, the aim of this study is, first, to characterize the joint gray-white matter contribution in higher versus lower trait anxiety, and second, to test the hypothesis that higher anxious individuals differ from lower anxious individuals in the triple network's regions (Default Mode, DMN, Central Executive, CEN, and Salience, SN, networks).

Starting from a large sample of young individuals, we extracted from it a higher anxiety and a lower anxiety group, according to the trait anxiety score obtained from the STAI. Then T1 and T2 images were analysed in the Fusion ICA Toolbox and CONN Toolbox. For the structural analysis, Fusion ICA and a logistic regression reported, in the higher anxiety group, decreased gray matter in a fronto-parietal and cerebellar circuit, and increased white matter in a fronto-temporal circuit.

For the functional analysis, Group-ICA second level and its 'spatial match to template' function reported, in the higher anxiety group, an increased functional connectivity in the resting-state components overlapping with the posterior DMN, the CEN and the SN.

Our study successfully found structural and functional networks separating higher from lower anxious individuals, supporting the development of brain-based "predictomes" for trait anxiety in young individuals.

Location: Cafeteria
Poster 2

Innovative App for Interpersonal Synchrony Training in Children with ASD

Omer Katz, Simone Shamay-Tsoory

Interpersonal synchrony, characterized by the alignment of behaviors or neural activity between individuals, plays a crucial role in fostering cooperation, affiliation, and group cohesion. Autism Spectrum Disorder (ASD) individuals often exhibit lower levels of synchrony, hindering their social development. This study investigates the potential benefits of a novel gaming application in enhancing both behavioral and neural synchrony in dyads of typical and ASD parent-child pairs aged 6-15. In the first lab phase, participants engaged in the gaming application which involved joint movement on the screen while Functional Near-Infrared Spectroscopy (fNIRS) recorded their neural activity simultaneously. The application provided live feedback on the levels of synchronization, encouraging improved synchrony. In the subsequent phase, participants were instructed to train in the task at home by playing 10 matches daily for four weeks, while the difficulty of levels increases. The final phase replicated the initial lab session, measuring both neural and behavioral synchrony. Preliminary results revealed differences between typical and ASD subjects in both neural and behavioral synchrony during the first and third phases. Notably, improvements were observed within both groups from the first to the third phase, indicating the potential for enhancing interpersonal synchrony through training. Although the study has yet to assess the impact on ASD symptoms, our goal is to observe diminished symptoms post-intervention, highlighting the potential of improving synchronization skills through this innovative gaming approach. This research offers a promising avenue for intervention and support for individuals with ASD who seek to improve their interpersonal skills.

Location: Cafeteria

Poster 3

Talking to my past: deepfakes for a hyperrealistic recreation of one's child image in self-dialogue settings

Marte Roel Lesur, Paulina Zybinska, Birgit Kleim

Self-compassion is an important explanatory variable in understanding and predicting mental health issues and resilience. It is understood as the tendency to soothe oneself with kindness and non-judgmental understanding in times of difficulty and suffering. The positive impact of “embodiment and enactment” and “externalising the self in physical form” has been recently highlighted in self-compassion psychotherapies. These aspects have been explored in remarkable uses of virtual reality, where situations of self-dialogue can be presented in sensu. Now, novel applications of deepfake technologies allow rendering the image of oneself as a child, enabling a hyperrealistic dialogue with a past self. This opens new opportunities for self-compassion therapies when innovative therapies are crucial, given the affliction caused by mental disorders, the high level of treatment resistance and remission, the huge economic costs associated. While this development is in the early stages of qualitative research, reflections on the possibilities and limitations for the use of deepfakes in psychotherapy are presented, along with the current technical advances by our group.

Location: Cafeteria
Poster 4

Individual differences in interoception and autistic traits share altered facial emotion perception, but not recognition per se

Julia Folz, Milica Nikolić, Mariska Kret

While alterations in both physiological responses to others' emotions as well as interoceptive abilities have been identified in autism, their relevance in altered emotion recognition is largely unknown. Therefore, we here examined the role of interoceptive ability, facial mimicry, and autistic trait levels in facial emotion processing. Participants in a first online experiment (N = 99) performed a facial emotion recognition task, including ratings of perceived emotional intensity and confidence in emotion recognition, and reported on the trait interoceptive accuracy, interoceptive sensibility and autistic trait levels. In a follow-up lab experiment involving 100 participants, we replicated the online experiment and additionally investigated the relationship between facial mimicry (measured through electromyography), cardiac interoceptive accuracy (evaluated using a heartbeat discrimination task), and autistic traits in relation to emotion processing. Although we observed reduced recognition for certain expressions with higher autistic trait levels in both experiments, the interoception measures and facial mimicry did not account for these effects. Higher trait interoceptive accuracy was rather associated with more confidence in correct recognition of some expressions, as well as higher ratings on their perceived emotional intensity. Exploratory analysis indicated that those higher intensity ratings might be the result of a stronger integration of instant facial muscle activations, whereas higher autistic trait levels seemed to be associated with less integration of facial muscle activations in perceived emotional intensity. Individuals on the autism spectrum might thus benefit from training interoceptive abilities to integrate their own physiological responses more beneficially in facial emotion processing.

Location: Cafeteria
Poster 5

Effects of apathy and anhedonia on effort-based decision making in adolescents with depression

Ningning Zeng, Yaner Su, Pengfei Xu, Katharina S. Goerlich, Yuejia Luo, Andre Aleman

Background: Apathy is a syndrome of reduced motivation that frequently occurs in neurological and psychiatric diseases, which is highly correlated with anhedonia, while the underlying mechanisms remain to be established. This study investigated the effect of apathy on effort-based decision-making in adolescents with depression.

Methods: Thirty-nine adolescents with depression and 50 matched healthy controls performed a physical effort-based decision-making task. Participants accepted or rejected to exert different levels of physical effort (small or large number of key presses) to obtain different magnitudes of rewards or avoid loss. Participants' choices were analyzed using a discounting model.

Results: Across participants, higher apathy levels were associated with reduced willingness to exert effort to obtain rewards, reflected by their decreased average accept rate and lower basic tendency. Besides, apathy and anticipatory anhedonia (rather than consummatory anhedonia) negatively predicted participants' acceptance rates.

Conclusions: Our findings indicate a diminished sensitivity to rewards and distinct effects of apathy and anhedonia on effort-based decision-making in adolescents, highlighting motivational deficits as a potential early diagnostic marker for depression in adolescence.

Location: Cafeteria
Poster 6

A Systematic Review on Cognitive biases in Gambling activities and Gambling Addiction

Colleen Verwacht, Nellia Bellaert, Mandy Rossignol, Thomas Brihay, Colleen Verwacht

Gambling involves the placement of an irreversible bet typically in the form of money, with the game's outcome being purely dictated by chance. Nowadays, gambling activity is carried out in many ways, such as slot machine games, scratch card games, poker, sport betting, etc. In the last decades, evidence has indicated that, when confronted with decisions involving risk, people do not necessarily behave as expected value maximisers. This may in part be explained by the existence of cognitive and perceptive distortions, which are patterns of thinking corresponding to systematic errors of judgment or decision-making that deviate from strict rational considerations. Distortions specific to gambling influence gamblers who persist in their behaviors despite negative consequences such as financial loss which, in extreme conditions, can lead to the development and maintenance of pathological gambling. Thus, we conducted a systematic review that aims to investigate cognitive and perceptual biases in gambling. This could provide a better understanding of gambling-oriented behaviors and how gambling addiction is influenced by these distortions, potentially leading to the development of more tailored interventions. Moreover, this could inform policymakers on how to regulate gambling activity in an evidence-based fashion. The protocol was registered in PROSPERO (code: CRD42023493755, December 2023). We performed the databases search on Scopus, PubMed, PsycINFO, EconBiz, and Google Scholar, and found 846 potential documents. The screening led to the inclusion of 48 articles, which were then evaluated. Aggregated results and methodological discussion are still in progress and will be presented at the conference.

*Location: Cafeteria
Poster 7*

Neurophysiology in the assessment of neuropsychological rehabilitation's efficacy: an experimental study with Acquired Brain Injury

Miguel Peixoto, Artemisa Dores, Tiago Paiva, Alexandre Castro Caldas, Fernando Barbosa, Andreia Geraldo

Research initiatives have been focusing on improving the understanding of mental processes by combining physiological and behavioral measures, enhancing the scientific knowledge regarding the relationship between brain functioning and behavior, including the efficacy of neuropsychological rehabilitation (NR). This study intended to add evidence about the contributions of neurophysiology, specifically brain connectivity, to assessing the efficacy of NR in Acquired Brain Injury (ABI).

Fifty Portuguese adults with ABI ($M_{age} = 42.06$; $SD_{age} = 11.26$; 48% female) were enrolled in this experimental study. All participants completed at least 4 years of formal education ($M = 10.26$; $SD = 3.71$) and the injury occurred during adulthood from 3 to 210 months prior to their enrollment ($M = 37.28$; $SD = 47.37$). Pre- and post-intervention neuropsychological assessments, with behavioral and neurophysiological measures, were conducted before and after completing a 24-week holistic NR program. Neuronal correlates were collected through a 5-min resting-state EEG protocol.

Improvements in the overall cognitive functioning, memory, attention and concentration, and updating abilities, as well as anxiety symptomatology decreases, and perceived quality of life and functionality improvements were found in behavioral measures as a consequence of NR. Similarly, significant increases in the beta band power in frontal sites were found from pre- to post-intervention assessments. Furthermore, results suggest that increases in low beta band power partially explain the decrease of anxiety symptomatology and the improvements of immediate recall.

Although preliminary, these results highlight the importance of combining multidomain measures when assessing the efficacy of NR programs.

Location: Cafeteria
Poster 8

Mood computational mechanisms underlying increased risk behavior in adolescent suicidal patients

Zhihao Wang, Bastien Blain

Background: Suicidal thoughts and behaviors (STB) are one of leading causes of death worldwide. Although literature has consistently reported increased risk behavior in patients with STB and has proposed mood problems as the core of STB, cognitive and affective computational mechanisms underlying increased risky behavior remain unclear.

Methods: Here, we asked 83 adolescent inpatients with affective disorders, where 58 patients with STB (S+) and 25 without STB (S-), and 118 gender/age-matched healthy control (HC) to make decisions between certain vs. gamble option with momentary mood ratings.

Results: After identifying increased risk behavior in S+ than S- and HC, we used approach-avoidance prospect theory model and momentary mood model to quantify patients' behavior and mood. Choice data analysis showed a significant increase in approach toward risky options in gain in S+ compared to S- regardless of the expected value difference between the options, suggesting impaired Pavlovian approach system in STB. Mood model showed significantly lower mood sensitivity to certain reward in S+ than S- and HC, which further significantly explained increased gambling decisions in STB, offering a mood computational account for increased risk behavior in STB. These results remain significant after controlling for demographic and clinical variables and medication factors.

Conclusions: Overall, our findings revealed cognitive and affective computational mechanisms underlying increased risk behavior in STB. This work has important implications for prevention and intervention of suicide, especially for clinical populations.

Location: Cafeteria
Poster 9

Oscillatory underpinnings of retrieval suppression and depressive rumination. An Electroencephalography Study.

Claudia Cogollos, María del Carmen Martín-Buro, Ricardo Bruña, Iván Blanco, Javier Pacios

Memory control is considered a fundamental mechanism for emotion regulation. In particular, retrieval suppression of undesired memories, and their associated forgetting, have been proposed to have a role in the individual tendency to ruminate. Previous studies have reported that people with depression struggle to downregulate memory intrusions, as characterized by decreased suppression-induced forgetting (SIF), which in turn makes them more vulnerable to depressive symptoms.

In this study, we aim to replicate previous evidence of reduce SIF in dysphoria and extend it by linking that effect with individual reports of intrusions, as well as with the prefrontal oscillatory response in the theta band. To do this, we will compare two groups of participants (Low Ruminators and Ruminator with Dysphoria), while they accomplish a Retrieval Suppression task that includes a trial-by-trial phenomenological report of intrusions. Time-frequency responses will be obtained through electroencephalography (EEG) recordings during the task.

We hypothesize: 1) Dysphoric participants will show a reduction in the SIF effect, along with a lower reduction of reported intrusions along the task. 2) The individual SIF effect and intrusions reduction should negatively correlate with rumination scores. 3) Dysphoric participants will show a decreased dorsolateral prefrontal theta response during the retrieval suppression attempts.

If the hypotheses are met, those results would confirm that retrieval suppression plays an important role in the control of ruminations, and therefore in the development of mood disorders. Additionally, they will extend our knowledge on potential brain vulnerabilities linked to this mechanism and depressive disorders.

Location: Cafeteria
Poster 10

Exploring Prosody Recognition in Glioma Patients: A reverse-correlation Study

Jean-Julien Aucouturier, Aude Warnery, Marie Villain, Aynaz Adl Zarrabi, Viviane Luherne-du Boullay, Célia Chauche-Lombard

Glioma, a common brain tumor, can considerably affects patients' cognitive and social abilities (Boone et al, 2016). This study investigates alterations in linguistic prosody recognition in glioma patients, pre-and post-surgery.

To do so, we employ a relatively novel psychophysical procedure which combines digital speech stimulus manipulations with reverse-correlation analysis (Ponsot et al., 2018). Patients with planned grade-II glioma surgery (Neurosurgery Dept, Hôpital Pitié Salpêtrière in Paris), are tested 1-3 weeks pre- and post-surgery, with a 30-minute assessment consisting of 300 trials with 2 random pronunciations of the word “really?” generated using the CLEESE toolbox (Burred et al, 2019). For each trial, participants are tasked to indicate which of the two words sound more interrogative. Participant responses are then analysed to extract both a pitch contour corresponding to how they mentally represent interrogative words (typically, a rising pitch contour), how consistently they use this representation (“internal noise”; Adl Zarrabi et al., 2023).

Data collection for the project is ongoing, and it is our aim to include a total of N=20 participants and report on our preliminary results at the time of the conference. In a recent study, a standard test of facial expression recognition showed significant differences between glioma patients and controls before surgery, but no impact of surgery (Buunk et al. 2022). However, because our procedure not only assess performance but also representation and internal noise, it has potential to reveal finer impacts of glioma and its resection, incl. the impact of the glioma's brain hemisphere location (Mattavelli, 2019).

Location: Cafeteria
Poster 11

Extrinsic Emotion Regulation Strategies Among Individuals with Subclinical Depression

Atheer Massarwe

Extrinsic emotion regulation (EER) is the provision of emotion regulation support to another person. An important question is what factors influence peoples' choice of EER strategy. The present study examined the role of depression symptoms in EER strategy use. Fifty-one women who reported high levels of depression symptoms measured by the Major Depression Inventory (MDI) and 48 women who reported low levels of depression symptoms participated in the study. They were asked to read 6 texts that described negative emotional situations ostensibly written by another participant. They were then asked to help the other participants by writing a supportive letter. The participants reported their motivation to help and emotions before and after providing support. Results showed that depressed and non-depressed participants reported more positive and less negative moods post-support. The coding of support letters indicated that depressed participants showed higher use of acceptance compared to non-depressed participants. However, non-depressed participants reported higher use of empathic responding compared to depressed participants. The motivation to help did not differ between the groups. These findings are consistent with previous findings showing that EER benefits support providers. To our knowledge, this study is the first to show which strategies subclinical depressed participants use to help others regulate emotions. Together, these findings imply that EER may be a good way to improve mood and that people with depression differ from nondepressed individuals in the ways they provide support to others. These findings have implications for understanding the role of EER in depression and other psychopathologies.

Location: Cafeteria
Poster 12

(Un)Real Dreams: a Semantic and Structural Analysis of Dream Reports In Depersonalisation Disorder

Anna Ciaunica, Francisco Gallo, Helge Gillmeister

Background: This study explores the uncharted territory of dreams in individuals experiencing Depersonalisation-Derealisation Disorder (DPD), a condition characterized by a persistent dream-like state and detachment from self and the world. While previous research has extensively documented the disruptions in self-awareness during wakefulness in DPD, the realm of dreams in these individuals remains unexplored.

Methods: 25 clinically diagnosed patients with DPD and 25 controls closely matched for age, gender, other health conditions and medication completed a 14-day dream diary. We used thematic analysis to investigate the frequency, vividness, and thematic content of dreams in DPD patients, comparing them with matched controls. We conducted semantic and structural analyses to provide a deeper understanding of the content and organization of the dream reports. We also looked at the concept of 'self continuity' in dreams, examining whether individuals with DPD feel as estranged and distressed in their dreams as they do when awake.

Results: The qualitative analysis focused on two overarching categories: Space and Time Perception, and Self and Others Perception. Semantic and structural analyses of dream reports revealed additional layers of meaning and organization within dream narratives, and we found that co-occurrence networks were more dispersed in DPD dream reports compared to networks in the control population.

Conclusion: our study sheds light on the subjective experiences of DPD patients during sleep, contributing to a comprehensive understanding of the disorder.

Location: Cafeteria
Poster 13

Interindividual differences such as anxiety modulate vicarious social touch perception

Louise Kirsch, Hanan Ez-Zahraoui, Aikaterini Fotopoulou, Mariana von Mohr

Social touch has been shown to be crucial for development and well-being. While tactile interactions have decreased drastically these past decades with the increase of people suffering from social isolation, and stress, there is a real need to better characterize the impact of individual factors on social touch perception.

In this presentation, I will put together the results of two set of studies shedding some lights on: (i) the impact of observed vicarious touch on stress levels thanks to an intervention study, and (ii) the physiological markers of observed vicarious social touch (i.e. heart rate, and heart rate variability), and how individual factors such as empathy and anxiety are mediating the effects.

In both studies, anxiety seems to be an important mediator of social touch perception via observation. For instance, individuals experiencing higher levels of anxiety prior to watching socio-tactile interactions exhibited a more pronounced calming response to vicarious social touch. This might explain why some individuals are or are not attracted towards social touch, and why observing positive social interactions may benefit more to some individuals.

Altogether, these studies highlight the necessity for future studies to better investigate the underlying mechanisms of vicarious social touch by taking into account individual differences. This is particularly important in order to understand to what extent vicarious social touch via observation could be used to reduce stress.

Location: Cafeteria
Poster 14

Social touch pleasantness: the mediating role of interindividual differences.

Hanan Ez-zahraoui, Louise Kirsch

Positive social touch is fundamental to convey emotions but also to understand others. Yet, varying ratings of touch pleasantness have been found, and it remains unclear how psychological states/traits can explain those results. To address this gap, we first conducted a systematic review, examining how interindividual differences in terms of psychological traits/states contribute to the perceived pleasantness of positive social touch. This review process underscored the defining role of psychological states including anxiety, depression, empathy as well as traits such as autistic traits and sensitivity traits, on touch pleasantness. Second, to establish experimental evidence of those links, we designed a behavioural paradigm centred on the observation of touch stimuli, incorporating a new social touch picture database. The database comprises a social touch condition (ST) focusing on positive human touch, along with two control conditions: social no touch (SNT) focusing on the social component of the pictures, and a non-social touch condition (NST) focusing on the specificity of human touch. Participants aged 18 to 40 assessed picture pleasantness and completed questionnaires such as the Interpersonal Reactivity Index to measure empathy levels, the Beck Depression Inventory to measure depression levels. We expect that an enhanced pleasantness will be specifically associated with lower levels of depression, and higher levels of empathy in the ST condition, compared to the other conditions (SNT, NST). Overall, this work will give us a better understanding of the key role of individual differences on touch pleasantness in healthy individuals.

Location: Cafeteria
Poster 15

Cross-cultural emotion recognition: A comparison study in Belgium and Rwanda

Rita Garcia Lima, Guillaume Pech, Victoria Rambaud, Emilie Caspar

Emotions are a fundamental aspect of social life. Recognizing and understanding others' emotions through facial expressions is crucial for communication. There has been a longstanding debate on whether recognizing emotions is universal or culturally specific. Recent studies suggest that culture variability modulates the recognition of emotional stimuli, particularly in the context of individualism-collectivism societies. However, how these distinct societies differ in emotional expression and to what extent is still unclear. This study aims to investigate emotion recognition accuracy across two cultural groups, one associated with a higher collectivism (Rwanda), and one with a higher individualism (Belgium). Participants will complete an emotion recognition task, and a questionnaire to assess the cultural context. During the emotion recognition task, participants will be presented with pictures of facial expressions of the six basic emotions (happiness, surprise, fear, sadness, disgust, and anger) and neutral, and decide which of the emotion names best describes the facial expression shown. The task will consist of two consecutive blocks – one presenting the own-culture emotional faces and another the other-culture emotional faces. We will evaluate the rate of error for each emotion and reaction times. We expect that for the members of the collectivist culture higher sensitivity will be observed to facial emotions compared to the individualist members. In conclusion, understanding the differences in emotional judgment between cultures is crucial for cross-cultural communication.

Location: Cafeteria
Poster 16

Effect of social network asymmetries on interpersonal coordination and brain dynamics

Aliaksandr Dabranau, Sune Lehmann Jørgensen, Ivana Konvalinka

(A planned project.) Each person is embedded in a specific pattern of social connections: while some people exist in tightly-knit communities, others might bridge distinct groups of individuals. What happens when individuals with different social network characteristics interact in real time? Who takes the role of a leader and who follows? How do social network parameters relate to the differences in neural activity? To map the asymmetries in social network properties to the behavioral and brain dynamics, we use the dual-EEG recording of pairs of individuals performing a spontaneous motor coordination task (finger flexion and extension). Before the coordination task, the subjects are asked to fill out a survey about the whole scope of their active contacts (family, friends, coworkers, etc.) and links between those contacts. On the behavioral level, the analysis focuses on the probability of taking the role of a leader, the strength of synchronization of finger movements, and the extent of adaptation of one subject to another as a function of social network parameters. On the brain level, in addition to investigating the single-brain power modulation of rolandic alpha- and beta-oscillations, we aim to explore how the effective connectivity between two brains relates to social network parameters and their asymmetries. We believe this study will not only enrich the body of real-time interaction research with the social context but also help us better understand and predict the dynamics of interactions within human social networks.

Location: Cafeteria
Poster 17

When action outcomes become emotional responses of others – the impact on sense of agency

Ilkay Ari

This study explores the interplay between intentional actions, action outcomes being emotional expressions of others, and the sense of agency (SoA). With a specific focus on expressions of sadness, we investigate how intentional vs. accidental cause of sad expression modulates one's own SoA. In our study, participants face a choice of giving the humanoid robot, iCub, one of two objects, each associated with making the robot either happy or sad. However, a given decision resulting in a given expression is only probabilistic. Thus, it might happen that even if a participant intends to cause a positive emotional reaction, the reaction turns out to be negative. In this case, a participant would accidentally cause a negative emotional expression, which would be contrasted to trials in which a participant intentionally chooses to cause a negative emotional expression. Utilizing the intentional binding paradigm, we measure SoA in an implicit manner. We predict that being exposed to trials in which negative emotional expressions were caused accidentally may prompt individuals to reassess the causal relationship between their actions and outcomes, potentially increasing SoA in those trials in which negative outcomes were a result of their intention. If confirmed, the hypothesis would cast a light on how dynamic interaction between emotion and cognition shapes individuals' sense of control while contributing to the models of cognitive flexibility and adaptation in socio-emotional settings. Overall, this study will shed light on the complex interplay between SoA, affective outcomes and the issue of intentional vs. accidental outcomes of actions.

Decomposing social cognition alterations in severe alcohol use disorder: A look at social memory

Arthur Pabst, Arnaud D'Argembeau, Pierre Maurage

Social cognition difficulties and their functional/ clinical consequences in severe alcohol use disorder (SAUD) are well described. However, which precise information processing alterations subtend these difficulties remains an important open question. Theory and preliminary evidence point to changes in memory for social information as one plausible class of candidate mechanisms. Here, we investigated two relevant social episodic memory processes in patients with SAUD and healthy controls: 1) the encoding of novel social information, through a variant of the Remember/ Know/ Guess with dynamic facial expressions of happiness and anger as stimuli; 2) the accessibility of/ fluency for already established social memories, by asking participants to retrieve as many specific memories of positive and negative interpersonal interactions as possible within equal time limits. We found that patients with SAUD, compared to healthy controls, showed 1) a tendential difficulty to encode the identities of facial expressions in general, but an equivalent bias favouring the encoding of positive vs. negative expressions, and 2) equivalent access to/ fluency for positive interpersonal memories, but increased access to/ fluency for negative interpersonal memories. These results provide the first characterization of social episodic memory in SAUD, extend recent findings in the attentional domain to refine our understanding of social information processing in this group, and point to specific social memory processes as potentially valuable and actionable treatment targets.

Location: Cafeteria
Poster 19

A Novel Electroencephalography-Based Paradigm to Measure Intergroup Prosociality: Intergenerational Study in the Aftermath of the Genocide Against Tutsis in Rwanda

Guillaume Pech, Darius Gishoma, Emilie Caspar

Experimental psychology seeks to understand behaviors, often focusing on a single behavior type due to time-intensive design. In contrast, approaches focusing on explicit reports, tend to be more sensitive to social bias than implicit measurements. This study introduces a new method to measure intended behaviors, coupled with implicit and electrophysiological methods. It further uniquely explores intended prosociality in a post-genocidal context, moving beyond classic convenience samples, by involving survivors and former genocide perpetrators in Rwanda, as well as their children. Participants had to choose recipients for their prosocial intentions from ingroup or outgroup individuals. We assessed the frequency of their selections and the cognitive conflict induced by each choice, measured via reaction times (RT) and mid-frontal theta activity (FM θ). The main finding of this study is that, 27 years after the genocide in Rwanda, there is still an observed bias in intergroup prosociality between survivors and former perpetrators. Specifically, we found that former perpetrators, despite explicitly stating their willingness to favor survivors, experienced more cognitive conflict when actually selecting them. It is noteworthy that this bias extends to the next generation. These results shed light on how historical conflicts shape intergroup prosociality bias and its transmission to future generations.

Location: Cafeteria
Poster 20

The influence of robot autonomy on sense of agency and trust towards a robot

Mateusz Wozniak

We conducted four online experiments in which we investigated how different types of robot autonomy influence sense of agency and trust. Participants played a game in which they selected which box should be collected by an avatar robot. They were also told that some robots have artificial intelligence and that these robots might collect different options than selected by the participants. At the end of the experiment, participants played a trust game with each robot. We compared a situation in which a robot disobeys participants' commands in order to benefit the participant by obtaining more points (helpful autonomy) versus when it disobeys them, but acquires the same payoff (non-helpful autonomy). Moreover, in Experiments 3 and 4 we compared two types of helpful autonomy: autonomy to avoid loss and autonomy to obtain extra gain. We found that helpful autonomy led to higher trust than non-helpful autonomy, except when it helped to avoid loss, but did so unreliably (Experiment 4). Second, trust was unrelated to the perceived sense of agency over autonomous robots. Participants reported experiencing more sense of control over robots with non-helpful than helpful autonomy in Experiments 1-2, where the behavior of autonomous robots could be compared with the behavior of robots that had no autonomy at all or behaved randomly. However, this relation was reversed in Experiments 3-4, where these control conditions were absent. Our results show that sense of agency can be modulated by robot's perceived autonomy, especially when one is exposed to different types of robot behavior.

Location: Cafeteria
Poster 21

Boosting reliance on exteroceptive priors to modulate implicit associations between the self and religious representations: a tACS study.

Gabriele Fusco, Giuseppe Ippolito, Alessandra Finisguerra, Luca Tarasi, Vincenzo Romei, Cosimo Urgesi

Religiousness (R) and Spirituality (S) are two multidimensional constructs that commonly characterize the existence of individuals. While R refers to the commitment of different aspects of the faith, including engagement in rituals, observance of traditions, and adherence to doctrines, S is associated with a subjective and intimate experience involving feeling of oneness, belongingness and transcendence. Predictive coding accounts suggest that representations involving R and S might be sensitive to sensorial priors related to external and internal states, respectively. The processing of such expected (perceptual) beliefs are indexed by electrocortical oscillations in alpha frequency that support information transfer within the hierarchical interplay of predictive stages. In the present pre-registered (<https://osf.io/ng75f>), single-blind, sham controlled, cross-over study, we aim to improve the reliance on exteroceptive priors and modulate plastic changes of R representations. Specifically, participants, while performing a binocular rivalry visual task, will undergo three separate sessions during which alpha-, gamma-, or sham- transcranial alternating current stimulation (tACS) will be administered over the occipital cortex. After the tACS offset, participants will also be required to complete an Implicit Association Test (IAT), enabling us to measure biases between the self and spiritual/religious concepts. In turn, we predict that boosting electrocortical activity in alpha rhythm will reinforce the prior manipulation increasing the selection of the congruent-visual prior stimuli as compared to sham and gamma stimulation. Ultimately, strengthening these priors is expected to increase R but not S.

*Location: Cafeteria
Poster 22*

Cortical activity during unpredictable screams: a fNIRS investigation

Teresa Baggio, Ivan Patanè, Deborah Ferrante, Alessandro Grecucci

Listening to unpredictable aversive sounds, such as screams, can induce specific neural responses, corresponding to the differential activity of emotional processing-related brain areas. Moreover, human screams have been shown to induce transient states of anxiety, being linked to a signal of personal or conspecific danger.

Previous research has investigated the neural basis of anxiety through invasive paradigms (i.e. electric shocks).

Our aim is to investigate the neural activity associated to states of fear and anxiety, induced by unpredictable screams, controlled by unpredictable safe sounds, such as human laughs. Additionally, we want to test if such transient states of fear/anxiety can impact the successive execution of tasks with a socio-emotional valence. We are planning to conduct a study with two randomized blocks for each participant, a “safe” and a “threat” block, with a proper interval between each other. Before and after each block an anxiety rating scale will be administered. During the blocks participants will hear unpredictable sounds, in particular laughs in the safe block, and screams in the threat block.

After each block participants will execute a virtual social task, including a human avatar approaching them starting from different distances, at a constant speed. Participants will have to stop the approach whenever they feel the proximity with the avatar is not comfortable anymore. For the entire duration of the two blocks cortical activity will be measured through fNIRS registration.

We expect to find differential cortical activity and social task response during the threat block with respect to the safe one.

Location: Cafeteria
Poster 23

Mental imagery drives emotion granularity during simulation of negative experience: a within-subject lab-based study

Caterina Vannucci, Giacomo Handjaras, Giada Lettieri, Emily Holmes, Luca Cecchetti

Introduction: It is not clear whether emotion intensity augments granularity through richer descriptions of emotion experience. As compared to verbal thinking, mental imagery acts as an amplifier since it is based on mechanisms of simulation. Thus, we compared intensity and granularity of emotion reports in response to mental images (MI) versus verbal thoughts (VT) starting from pictures paired with a word-cue (PWC).

Aim: To analyze differences in self-reported emotion experience in response to MI vs VT.

Methods: Thirty participants ($F=15$) underwent a lab-based study with a within-subject design. Participants generated positive or negative MI and VT based on 60 PWC. They were asked to rate affect intensity and give a report of the emotions and bodily sensations experienced, and finally to regulate their emotions, after every mental representation. Also, participants completed an episodic memory task.

Results: Only in response to negative MI (vs VT, $p<.05$), a generalized linear mixed-effects model showed that participants experienced more intense negative affect and used more words and bodily sensations to describe their emotions. No difference in embeddings of self-reports or emotion regulation was found. Lastly, we confirmed that MI is more autobiographical than VT ($p<.05$).

Conclusions: When negative, simulation via MI may lead to more granular emotional experience than VT. We built on previous literature showing MI is more autobiographical and leads to more intense affect. Imaginal representations may carry more emotional information as compared to their verbal counterparts.

Location: Cafeteria
Poster 24

Sorry I overreacted: The role of core affect in the modulation of motor resonance during face-to-face interaction

M. Isabel Casso, Hendry F. Chame, Patrick Henaff, Yvonne N. Delevoye-Turrell

Growing research converge to show face-to-face interaction mutually influences spontaneous postures and gestures. This phenomenon is referred to as motor resonance. Studies on psychotherapy sessions, reported spontaneous and mirrored body movements emerged in therapists and patients (Ramseyer & Tschacher, 2011).

However, affective context may play a role in the strength motor resonance. Based on the philosophical framework by Mühlhoff (2015), we propose to test the affective resonance theory.

In a face-to-face study, we used the social robot Nao to investigate the role of affective context (i.e., positive or negative) in triggering motor resonance in humans. Nao was programed to exhibit cowering (sad) or open (happy) body language; Nao moved slow or fast to exhibit energy levels. Participants attended a single experimental session during which Nao moved slow and fast, while it narrated a sad or happy stories. Concurrently, the kinematic activity of each participant was recorded using a motion-capture system. Additional measures included self-reported affect, and a questionnaire pertaining to the robot's social attributes.

Results show that more human body movements and sway were measured when Nao moved fast than when it moved slow. Additionally, movement patterns were influenced by the affective context. Overall, our results indicate that core affect can influence interaction dynamics. Future studies manipulating emotional context need to be conducted now in human-human interaction to generalize the affective resonance theory to social interaction.

Location: Cafeteria
Poster 25

Social valuation and decision-making in social anxiety

Franziska Eichhorn, Lisa Grebe, Hannah Valentin-Krebs, Rupert Conrad, Johannes Schultz

This study aimed to compare aspects of social interactions in 30 people with diagnosed social anxiety and matched controls using three experimental paradigms. Participants completed a decision-making task that measured social avoidance (Exp 1; Schultz et al., 2019), a Becker-DeGroot-Marshak second-price auction that quantified participants' value of obtaining positive and avoiding negative social feedback (Exp 2), and a social decision task that assessed the impact on happiness of responsibility for outcomes to self and a partner (Exp 3; Gädeke et al., 2020). Compared with controls, people with social anxiety were more risk averse but only showed a trend towards higher social avoidance (Exp 1); paid more to obtain positive and to avoid negative social feedback (Exp 2); and were more sensitive to negative outcomes for their experiment partner, irrespective of whether these outcomes resulted from their own choices or not (Exp 3). Our findings suggest that people with social anxiety do not attempt to avoid social interactions or social feedback, but are willing to spend more to influence the type of feedback they receive, and are more sensitive to the consequence of choices on others. Generally, our results suggest that tasks inspired by behavioural economics may be useful for quantifying the impact of differences in social cognition on social decision-making.

Location: Cafeteria
Poster 26

From sweaty to biting – crafting a multilingual lexicon for body odors across 17 countries

Antonie Bierling, Asifa Majid, Fatma Bilem, Leah Bloy, Andres Jimenez, Venla Kamppari, Pavlina Kyjaková, Mariano Mastinu, Annet Schirmer, Edgardo Silva, Lana Takau, Evelina Thunell, Kedarmal Verma, Bernard Vaernes, Chi Man Yee, Bastia Zyzelewicz, Illona Croy

Body odors are influenced by a range of physical processes, including genetic predisposition, hormonal changes, inflammatory processes, nutrition, and emotions. While these changes can be perceived by humans and affect social interactions, they are challenging to articulate. Previous research has utilized a limited number of verbal terms to describe differences in the perception of body odors between or within individuals. Most studies focus on pleasantness, intensity, and measures of attractiveness. However, these general labels may not be sufficient to capture the nuanced qualitative differences that result from the chemical composition of different body states. Our study aimed to create a multilingual lexicon to describe body odors. To this end, we conducted an online survey with 2,647 participants from 17 different countries speaking 13 languages. Participants were asked to provide words or phrases that describe body odors of individuals who are healthy, sick, stressed, or have exercised. The most frequent descriptions from each language were then translated into English for comparison. Initial results indicate clear differences in the way body odor is described. For instance, body odor caused by physical activity is often labeled “sweaty”, while body odor caused by illness is more commonly described as “biting”. Further results on common and unique patterns across languages will be presented. In conclusion, this study establishes a set of verbal labels for describing body odors that can be utilized in studies of body odor perception.

Saturday, May 25th 2024 // 1:00pm - 3:00pm

Location: Cafeteria
Poster 27

Using fNIRS to measure the sense of self of Marvel Cinematic Universe Fans (MCU) whilst they watch MCU film clips

Dwaynica Greaves, Emma Osterrieder, Riko Munakata, Antonia Hamilton

BACKGROUND: Parasocial bonds are when people have one-sided attachments with a media figure or fictional character. Previous research has found that high trait identification with a fictional character can lead to a self-other neural overlap in the vmPFC suggesting the effects of parasocial bonds (Broom et al., 2021). In this present study, moving on from our previous work on actor's, characterisation and the effects on their sense of self, we were interested in non-actors who are fans of characters from the MCU franchise's processing of a familiar character compared to self. **PARTICIPANTS:** 38 MCU fans with no acting experience, as we are also interested in the difference between how actors and non-actors process the sense of self whilst engaging with characters. **DESIGN:** We recorded participants mPFC responses to hearing their own, familiar character and stranger name whilst watching MCU film clips, colouring in a mandala colouring book (control), and watching nature landscape videos (control). Each task was conducted whilst seated, lasted 2 minutes and was repeated 4 times in the same listed order. Name calls occurred pseudo-randomly between 17-22 seconds within 2 minutes. The entire session lasted 24 minutes. **EQUIPMENT:** Shimadzu LIGHTNIRS functional near-infrared system with 22 channels was used to measure PFC activity. Biosignalsplux physiology system was used to measure breathing rate and head acceleration. **FINDINGS AND CONCLUSIONS:** Data collection is half complete and will be finished by Feb 2024. We predict that there will be an effect of condition type and name type on MCU fan's mPFC activity.

Location: Cafeteria
Poster 28

The social dynamics of learning with others

Sara De Felice

Social interaction plays a key role for optimal human development and supports learning throughout our life. Accumulating evidence suggests that people learn more in social interaction compared to solo-learning. But what are the underlying mechanisms of social learning? We designed a paradigm where participants learned a series of unknown facts from a partner during unconstrained face-to-face interaction. Using functional Near Infra-Red Spectroscopy (fNIRS) hyperscanning, 27 dyads (N=54) learned in conversation with their partner, alternating roles between teacher and student, while audio, video, head-movement, physiology and brain data was collected. While interaction was unconstrained, we manipulated whether participants could see their partner, by placing a separator in between the two in half of the trials. Learning performance did not differ between conditions, while joint attention was the strongest predictor of learning. Inter-brain coherence analysis reveals a complex dynamic between neural responses and behavioural metrics. Mutual gaze and joint attention were found to modulate brain synchrony over left DLPFC and left TPJ in supporting learning in social interaction. Ongoing analysis includes a large cross-brain GLM, where the neural, physiological, verbal and non-verbal behavioural measures of participant A are jointly taken into account to predict the neural activity of their interlocutor (participant B). Results are discussed in the frame of the mutual-prediction hypothesis, and advocate for a multi-modal investigation of social learning to fully understand its underlying cognitive mechanisms. Overall, this work advances the current understanding of naturalistic social interaction and has theoretical implications for cognitive models of information exchange between interacting minds.

Location: Cafeteria
Poster 29

Don't judge a book by its cover: The effect of perceived facial trustworthiness on value-based decision-making.

Mathias Van der Biest

When interacting, we spontaneously evaluate the social attributes of others. One such attribute is trustworthiness. The trustworthiness of others influences who we ask information from, or what direction we take in a virtual maze (Hale et al., 2018). Recently, Van der Biest et al. (2020), showed that we follow the advice of trustworthy advisors more and faster, compared to untrustworthy advisors. However, their trustworthiness manipulation was based on the validity of the advice, and its impact in different task contexts remained limited. Here, we overcome this context dependency and manipulate trustworthiness based on perceptual cues (facial appearance) while keeping the validity identical. This to investigate the impact of trustworthiness on value-based decisions. In two experiments, participants played a modified version of "The Door Game," in which they searched for a reward behind one of two doors based on the advisors' advice. In experiment 1 (N=124), we showed that participants followed the advice of the trustworthy advisor more, but only during the first half of the experiment. In experiment 2 (N=300), we successfully replicated our findings, and in addition found that during the first block, participants make faster decisions when the advisor is trustworthy. Overall, our results demonstrate the influence of perceptual trustworthiness during value-based decision-making. In addition, we showed that this effect is time restricted, potentially due to the dynamic nature of trust or changes in decision strategy.

Location: Cafeteria
Poster 30

Neural markers of social brain activation in human-robot interaction

Jairo Perez Osorio

With the imminent introduction of artificial agents into our digital future, robots will become teammates, companions, and counterparts. However, it remains unclear whether people would interact with humanoid robots as social partners or use them as mere tools. This project seeks to identify neural markers of the activation of social cognitive mechanisms with robots based on hemodynamic responses using supervised ML models. This will determine whether the human brain interprets the behavior of a humanoid robot using social (e.g., mirror neuron system, theory of mind) or general domain cognitive mechanisms (e.g., attention, cognitive control). With a hypothesis-driven and stepwise approach, the project will measure hemodynamic responses with functional near-infrared spectroscopy (fNIRS) in brain regions associated with social cognition, theory of mind, and perception of mental states during collaborative interactions with humanoid robots. Hemodynamic signal features will be included in the machine learning models to identify predictors of social or general domain cognitive mechanisms. The project's interdisciplinary nature integrates well-documented methods of cognitive neuroscience, advancements in robotics, and state-of-the-art machine learning techniques to thoroughly evaluate the factors that modulate the activation of the social brain exposed to humanoid robots. Outcomes will set standards for future research in human-robot interaction, offer a reliable tool for designers to measure the effect of robot behavior on the users, and boost the development and improvement of efficient human-robot collaboration.

Location: Cafeteria
Poster 31

The impact of social reward on imitative tendencies in virtual reality

Maura Nevejans, Emiel Cracco, Jan De Houwer, Jan R. Wiersema

According to motivational theories of imitation, humans imitate because they have learned from past experiences that this leads to social reward, such as positive reactions by others. However, one prerequisite for a positive reaction is that the imitated person sees the imitative behavior. The current study investigated the impact of the imitated person's eyesight and reaction to imitation on imitative tendencies using an ecologically valid imitation task in virtual reality. Participants (N = 110) were placed in a virtual art gallery together with two virtual agents. To manipulate the agents' eyesight, the agents were sometimes blindfolded during the task. Participants were instructed to react to two different auditory cues with a head movement to the left or right. At the same time, one of the virtual agents also made a left or right head movement. When the agents could see the participant, they reacted to the participant's movements: one agent smiled whereas the other frowned when participants looked in the same direction as them. We expected participants to imitate the agent who liked being imitated - but not the agent who disliked being imitated - more when the agent could see them compared to when they were blindfolded. The results revealed that participants had the tendency to imitate the agents, but, contrary to our expectations, this tendency was not influenced by the emotional reactions of the agents nor their eyesight. The absence of social influences prompts us to consider imitative tendencies as habitual behavior.

Location: Cafeteria

Poster 32

Exploring the Role of Sense of Ownership in Dishonest Behavior: Insights from Immersive Virtual Reality and Electrocortical Signatures

Giulio Piperno, Marina Scattolin, Stella Petkovic, Riccardo Villa, Maria Serena Panasiti, Salvatore Maria Aglioti

In a previous study, we found reduced Sense of Ownership (SoO) leads individuals to behave more dishonestly in their pursuit of high (versus low) rewards. This suggests that reductions in SoO may distance oneself from own immoral behavior, though the underlying neurocognitive mechanism remains unclear. In the current study, we ask participants (80 planned, 44 tested) to engage in a card game in a Virtual Reality environment, where they have the possibility to increase their gains through deception. Participants control a virtual body that is presented from first-person perspective (1PP; high SoO) or third-person perspective (3PP; reduced SoO). To gain a deeper understanding of the underlying neurocognitive processes, we use EEG to measure brain activity. Our goal is to determine whether the observed increase in dishonesty at lower SoO levels is associated with distinct perceptions of reward cue, or it emerges from differential neurocognitive mechanisms governing the action implementation. To this end, we are focusing on the P300 following the presentation of reward cues and the readiness potential (RP) preceding decision-making. Our preliminary findings indicate an overall higher P300 cue-response in the 1PP compared to the 3PP condition and a greater RP difference between honest and dishonest decisions in the 1PP versus 3PP condition. These results suggests that differential behavior at lower SoO levels could be due processes of detachment occurring both during reward perception and motor implementation.

Location: Cafeteria
Poster 33

Interpersonal Synchrony of Heart Rates as a Measure of Social Engagement in Real World Settings

Hanlu He, Ivana Konvalinka, A. Josefine Munch Sørensen, Jeppe Høy Christensen

Interpersonal physiological synchrony (IPS) has been increasingly studied in recent years as both a mechanism underlying social bonding and alignment as well as a method for quantifying joint engagement. In this study, we explored the use of IPS for measuring social engagement in real-world settings across which a group of individuals interacted or jointly attended different events, with varying degrees of acoustic complexity. By utilising wearable sensor data, we analyzed inter-subject correlation of heart rates (ISC-HR) of 72 individuals across various social scenarios in New York City. We hypothesised that ISC-HR would only be significantly increased during events characterized by close-proximity interactions and stimulus-driven scenarios, but not in settings marked by dispersed interactions and free movements. This is well aligned with previous findings of ISC-HR, though which were investigated in the absence of interaction in lab-based settings (Pérez, et al). Significant ISC-HR levels were found when participants were directly interacting in close proximity or jointly attending to the same stimuli, but not when they were dispersed, in contrast to HR signals that were circularly shuffled. Additionally, we explored whether acoustic environments with higher Signal-to-Noise Ratios (SNR) would foster enhanced engagement and subsequently higher ISC-HR levels. Our findings revealed a complex interaction effect between acoustic complexity and events, signifying the context-dependent nature of ISC-HR. The findings of the study demonstrate the generalisability of IPS to ecologically valid settings, and raise new possibilities for further investigations into understanding the complex relationship between the acoustic conditions, physiological signals, and social interaction.

Location: Cafeteria
Poster 34

INVESTIGATING THE ROLE OF INTERPERSONAL 'MOTOR DISTANCE' IN ACTION UNDERSTANDING: THE CASE OF TARGET OBJECT'S WEIGHT ESTIMATION

Jordi Manuello, Camilla Maronati, Luigi Cuturi, Riccardo Guidotti, Andrea Cavallo

Research on movement kinematics has demonstrated that agents can predict the weight of a target object through the observation of the reach-to-grasp phase of a movement towards it. However, it remains unclear the extent to which the 'motor distance' between the observer's and agent's kinematics (i.e. similarity of the way in which the movement is performed) affects this accuracy. To address this, we combined motion capture technology with video recording to collect data from 90 participants performing grasping movements towards a light and heavy version of a visually identical object. We used Procrustes transformation to determine the motor distance between participants, and in a subsequent action observation experiment we tested whether increasing distance between the observer and the observed action was associated with lower accuracy in weight class detection. We presented 20 observers (10 males) - who had previously performed the action execution task - with a set of 240 videoclips by manipulating the motor distance between their kinematics and that presented in the videos. Observers were asked to watch the reach-to-grasp phase of the action and to classify the target objects as heavy or light. In line with our hypothesis, the ANOVA confirmed ($p < 0.05$) that observers were more accurate (and faster) when the observed action had a lower motor distance (i.e. showing more similar kinematics) from them.

This is one of the first attempts to experimentally manipulate motor distance, suggesting that the ability to predict the outcome of observed actions depends on the kinematic similarity between observer and agent.

Location: Cafeteria
Poster 35

Increased sensitivity to social hierarchy during social competition versus cooperation

Yaner Su, Sander Martens, Katharina S Goerlich, Pengfei Xu, Yue-Jia Luo, André Aleman

Social hierarchy is the basic structure of the social organization. The ability to quickly recognize social hierarchy information is essential for social adaptation. Although social contexts such as competition and cooperation have a different influence on the processing of social hierarchy, the findings are partly inconsistent. Here, we used fast periodic visual stimulation (FPVS) with electroencephalography (EEG) to explore the neural signature of social hierarchy in the competitive and cooperative contexts, respectively. Participants first learned hierarchical faces during a competitive game or cooperative game. We then sequentially presented the learned hierarchical faces with a specific frequency in a set of faces. Results showed that participants rated the inferior player lower in the cooperative context compared to the competitive context, indicating that social context affects the judgment of others' rank. Moreover, higher neural responses to high and low-hierarchy faces versus medium-hierarchy faces were observed, suggesting rapid discrimination of social hierarchy from faces. Interestingly, rank-specific neural responses were more pronounced in the competitive context than in the cooperative context, indicating increased sensitivity to social hierarchy during social competition versus social cooperation. This study provides behavioral and neural evidence for rapid, automatic processing of social hierarchy information and for an increased sensitivity to such information in competitive versus cooperative social contexts.

Location: Cafeteria
Poster 36

Social Learning of Emotion and Its Implication for Memory: An ERP Study

Sriranjani Manivasagam, Anne Schacht

Social learning of emotion from surrounding social cues is immensely beneficial in uncertain environments. Theoretically, social learning has been suggested to follow simple associative learning mechanisms, leading to attentional and perceptual modifications of target environmental stimuli due to an assumed transfer of salience from social cues. However, the neural dynamics accompanying the salience transfer and the preservation of salience in long-term memory remain unclear. The present study (N = 90), conducted over two consecutive days, aims to investigate whether salience transfer occurs during social learning under uncertainty, and the underlying neurocognitive modulations, as well as salience preservation in memory after the expected salience transfer. In the learning session (day 1), salience transfer from social cues to target stimuli is expected to occur due to the prevailing uncertainty, reflected in better task performance and enhanced ERP amplitudes of early and late latencies towards target stimuli. In the test session (day 2), in the absence of social cues, we expect additive effects of salience from social cues and inherent salience of target stimuli, essentially indicating preservation of salience in the target stimuli. Preliminary results (N=20) suggest that social cues facilitate salience transfer to the target stimuli due to the prevailing uncertainty during the learning session, indicated by greater target valence classification accuracies and enhanced early ERPs. In the test session, trends indicate preservation of learned salience in the target stimuli in the early stages of processing, reflected in larger ERP amplitudes for positive and negative target stimuli previously associated with social cues.

Location: Cafeteria
Poster 37

Dissecting the functions of the medial prefrontal cortex during thinking about the self and others

Marie Levorsen, Ryuta Aoki, Constantine Sedikides, Keise Izuma

Previous research suggested a strong link between the medial prefrontal cortex (mPFC) and self-processing, leading to claims about the mPFC's specificity to the self. However, its involvement in various social/cognitive processes, such as other-reference, autobiographical memory, and introspection, has cast doubt on this specificity. The aim of this study was to investigate whether self-reference processing shares similar or distinct activation patterns in the mPFC compared to other-reference, autobiographical memory, and introspection. Using functional magnetic resonance imaging (fMRI), we scanned 35 participants while they performed a self-reference task, an other-reference task, an introspection task, and an autobiographical memory task, in addition to control tasks. We used multi-voxel pattern analysis (MVPA) to compare the underlying neural code of these processes. Our MVPA results showed that mPFC activation patterns evoked by the self-reference task were distinguishable from each of the other-reference, autobiographical memory, and introspection tasks. However, we also found evidence that activation patterns during the self-reference task were similar to those of the other-reference, autobiographical memory, and introspection tasks, suggesting that there are shared cognitive processes common to the self-reference task and each of the other three tasks. The other-reference task showed similar results; other-reference neural responses were systematically similar but still distinguishable from the other three tasks. Taken together, the present study provides consistent interpretations of previously reported mPFC activations by various tasks and a critical insight into the role of the mPFC in thinking about the self and others.

Location: Cafeteria
Poster 38

Exploring Generalized Brain Patterns in Affiliative Responses: Inter-Subject Pattern Analysis for Own vs. Unknown Kin

Tiago Soares Bortolini, Maria Clara Laport, Jorge Moll

Understanding the neurobiology of affiliative responses towards one's own kin is crucial for comprehending the foundational aspects of social cognition and bonding. This study employs inter-subject pattern analysis with a group-level approach, utilizing leave-one-subject-out cross-validation (Wang et al. 2020), to elucidate the between-subject neural networks and regions consistently involved in these affiliative responses. Our objective was to uncover consistent neural networks and brain regions activated across participants, pinpointing a 'generalized' response to affiliative stimuli. Utilizing an open dataset, we analyzed the brain responses of mothers viewing pictures of their own child versus an unknown child (N = 25). Leave-one-subject-out cross-validation was applied, generating accuracy maps for each fold through searchlight decoding, with the left-out individual serving as the test portion of the sample to assess neural patterns corresponding to the evaluated categories (own vs. other children). Preliminary results, applying Family-Wise Error corrections at the cluster level, indicated significant clusters in the subgenual area and near the septo-hypothalamic region, both areas that have been previously linked to affiliative stimuli. Additionally, there was a bilateral pattern in the anterior insula, consistently associated with social emotions. We are currently searching for additional data sets to increase the sample size for training and classification, which is currently sub-optimal, considering previous studies using similar analyses. If confirmed, these findings promise to deepen our understanding of the neural foundations of social cognition and affiliative behaviors, highlighting the potential for generalizable patterns in brain responses to affiliative stimuli.

Location: Cafeteria
Poster 39

The Extended Neural Architecture of Human Attachment: An fMRI Coordinate-Based Meta-Analysis of Affiliative Studies

Maria Clara Laport, Tiago Bortolini, Sofia Latge-Tovar, Ronald Fischer, Roland Zahn, Ricardo de Oliveira-Souza, Jorge Moll

Functional imaging studies and clinical evidence indicate that cortical areas relevant to social cognition are closely integrated with evolutionarily conserved basal forebrain structures and neighboring regions, enabling human attachment and affiliative emotions. The neural circuitry of human affiliation is continually being unraveled as functional magnetic resonance imaging (fMRI) becomes increasingly prevalent, with studies examining human brain responses to various attachment figures. However, previous fMRI meta-analyses on affiliative stimuli have encountered challenges, such as low statistical power and the absence of robustness measures. To address these issues, we conducted a coordinate-based meta-analysis of 79 fMRI studies, focusing on personalized affiliative stimuli, including one's own infants, family, romantic partners, and friends. We employed complementary coordinate-based analyses (Activation Likelihood Estimation and Signed Differential Mapping) and conducted a robustness analysis of the results, which revealed cluster convergence in cortical and subcortical structures related to reward and motivation, salience detection, as well as social bonding and cognition. Our study offers a thorough exploration of the neural correlates underpinning affiliative responses, effectively overcoming the limitations noted in previous meta-analyses. It provides an extended view of the neural substrates associated with affiliative stimuli, illuminating the intricate interaction between cortical and subcortical regions. Our findings significantly contribute to the understanding of the neurobiology of human affiliation, expanding the known human attachment circuitry beyond the traditional basal forebrain regions observed in other mammals to include uniquely human isocortical structures.

Location: Cafeteria

Poster 40

Mind's kaleidoscope: Exploring varying levels of alexithymia and narrative point-of-view in shaping theory of mind ability following reading a story

Danyal Tohidi Nasab, Khatereh Borhani

This study investigates the immediate impact of alexithymia levels and narrative point-of-view (PoV) on story engagement and socio-cognitive abilities following reading a short story. Utilizing a 2x2 between-subjects design with narrative PoV (first- vs. third-person) and alexithymia levels (low vs. high) as independent variables, the research centers on Theory of Mind (ToM) ability as the dependent variable. Based on a prior analysis considering a moderate effect size of 0.25 and a targeted power level of 0.8, a minimum sample size of 180 is necessary. The study unfolds in two phases, commencing with a screening phase (Phase-I) involving the Farsi version of the 20-item Toronto Alexithymia Scale (FTAS-20) and the Persian-language Beck Depression Inventory (control variable) for eligibility assessment. Participants scoring between 37 and 60 on the FTAS-20 are excluded, concentrating on those with Low Alexithymia and High Alexithymia. Eligible participants proceed to Phase-II, where they are randomly allocated to either the first-person or third-person PoV reading group of Anton Chekhov's "Misery." Prior to the in-lab session, participants are assessed for their advanced affective ToM using the online Persian version of the Reading the Mind in the Eyes Test. In the lab, participants read the short story and complete various assessments, including the Yoni short version, the transportation scale, and the identification questionnaire. In this ongoing project, we expect results to reveal how personal pronouns and alexithymia impact ToM ability post-fiction reading, contributing to understanding immediate effects of individual differences and textual properties on socio-cognitive impacts of fiction.

Location: Cafeteria
Poster 42

Temporal Dynamics of Cognitive Effort Discounting in Monetary Reward Decision-Making

Yang Yang

Effort discounting describes the devaluation of rewards that require effort to obtain. The present study explored whether the discounting of cognitive effort depends on temporal proximity to exert effort. Furthermore, this study investigated whether effort discounting, and its modulation by temporal distance to the effort, might depend on need for cognition, a personality trait that describes how much one enjoys cognitively demanding tasks. Participants engaged in a validated effort discounting task that measured the extent to which they subjectively devalued a £20 reward when cognitive effort was a prerequisite. The study manipulated the immediacy of effort by having participants imagine exerting varying levels of effort immediately, in a day, in 3 days, in a week, in 2 weeks or in a month.

The hypotheses propose a potential linear increase in reward discounting in response to both the magnitude of effort and the immediacy of effort. Anticipated findings suggest that individuals with lower need for cognition may exhibit increased overall effort discounting, potentially increasing linearly as effort becomes more imminent. Conversely, individuals with higher need for cognition are expected to display less effort discounting, a tendency unaffected by the immediacy of the effort.

This study contributes to understanding decision-making processes associated with cognitive effort. Beyond theory, understanding how people discount effort based on time and cognitive preferences has practical implications for designing interventions in areas like education and the workplace. These insights can contribute to personalized motivational strategies, considering individual cognitive needs.

Location: Cafeteria
Poster 43

Cortical responses to looming sources are explained away by the auditory periphery

Rudradeep Guha

A wealth of behavioral evidence indicates that sounds with increasing intensity (i.e. appearing to be looming towards the listener) are processed with increased attentional and physiological resources compared to receding sounds. However, the neurophysiological mechanism responsible for such cognitive and affective amplification remains elusive.

Here, we show that the large differences seen between cortical responses to looming and receding sounds are almost entirely explained away by nonlinear encoding at the level of the auditory periphery. We collected EEG mismatch negativity (MMN) data in response to deviant stimuli with both dynamic (looming and receding) and constant level (flat) differences to the standard in the same participants. We then combined a computational model of the auditory periphery with generative EEG methods (temporal response functions, TRFs) to model the single-participant MMN responses to flat deviants, and used them to predict the effect of the same mechanism on looming and receding stimuli. The flat model explained a remarkable 45% variance of the looming response, and 33% of the receding response.

This provides striking evidence that MMN responses to looming and receding sounds result from the same cortical mechanism that generate MMN to constant-level deviants: all such differences are the sole consequence of their particular physical morphology getting amplified by peripheral auditory mechanisms. Not all effects seen cortically proceed from top-down modulations by high-level decision variables. Rather, they can be performed early and efficiently by peripheral mechanisms that, one could argue, evolved precisely to spare subsequent networks with the necessity to implement such mechanisms.

Location: Cafeteria
Poster 44

Do Threatening Faces Hold Attention Automatically? Evidence from an Eye-Tracking Study

Mario Carlo Severo, Manon Mulckhuysse

Swiftly responding to threatening cues in the environment is vital for survival. While existing research indicates the automatic attentional capture of threatening faces, the automaticity of delayed attentional disengagement by task-irrelevant threatening faces remains unexplored. As such, this study employs an eye-tracking methodology to investigate the influence of threatening and non-threatening facial expressions as task-irrelevant cues within contexts of varying working memory load. Sixty participants perform an adapted spatial cueing paradigm where their saccadic response latencies to neutral peripheral targets are compared when either a task-irrelevant angry or a neutral facial expression is presented at fixation, while at the same time maintaining either 1 digit or 6 digits in working memory. Moreover, the study examines the impact of trait anxiety on attentional disengagement from threatening faces, building upon prior findings of attentional bias in high anxious individuals. We expect participants to display longer saccadic latencies when an angry face is presented in comparison to a neutral face, irrespective of the working memory load condition. Additionally, we expect this pattern to be more pronounced in high anxious individuals than their low anxious counterparts. Overall, the findings of the study at hand can deepen current understanding of the automaticity involved in attentional processing of threatening faces and offers valuable insights into addressing attentional bias in anxious individuals.

Location: Cafeteria

Poster 45

Is Task Switching Avoided to Save Effort or Time? Shorter Intertrial Durations Following Task Switches Increase the Willingness to Switch

Jonathan Mendl, Gesine Dreisbach

Human decision-making is often described in terms of cost-benefit analyses. In voluntary task switching, the typical avoidance of task switches (repetition bias) has been primarily explained by effort costs. The present study investigated whether temporal costs independent of effort also guide the decision to switch. In two preregistered experiments (NE1=86; NE2=85), we used a hybrid task-switching paradigm with a mixture of predetermined (forced-choice) and voluntary (free-choice) trials. The duration of the intertrial interval after a switch was manipulated between blocks to be either always longer or shorter than after a repetition. The results showed increased voluntary switch rates in blocks with a shorter interval following switches whereas the performance was not affected. Moreover, the effect was still evident in Experiment 2, where the interval was manipulated only after forced-choice task switches. This suggests that the temporal costs associated with switching contribute to the switch avoidance.

Location: Cafeteria
Poster 46

The influence of human chemosignals on motor inhibition

Elisa Dal Bò, Cinzia Cecchetto, Letizia Zurlo, Javier Albayay, Massimiliano Zampini, Claudio Gentili

Executive functions are cognitive processes crucial for goal-oriented actions, adaptability, and effective social interactions. Inhibitory control, a core executive function, involves suppressing thoughts and behaviors misaligned with current goals. This inhibitory ability is influenced by a combination of individual and environmental factors. Social context has been shown to affect inhibitory control, with studies indicating enhanced control in the presence of others. Olfactory stimuli, particularly body odors (BOs), are an effective modality of social communication, being able to convey information about the identity and the emotional state of the sender. These stimuli are unintentionally conveyed by the sender and unconsciously processed by the receiver. However, humans can discriminate between familiar and stranger BOs, and exposure to BOs can unconsciously influence behavior. This pre-registered study aims to determine the effect of BOs on motor response inhibition in healthy individuals. Participants performed a modified Go/No-Go task during the contextual presentation of BO collected from male and female donors. The study is currently underway, but we aim to test a total of 200 healthy women who will perform the task under exposure to cedarwood oil (masker), female BO (masked with cedarwood oil), masked male BO, or clean air. Behavioural (i.e., response times and average Go and No-Go error rates) and psychophysiological responses (i.e., heart rate variability and skin conductance) will be collected and analysed through mixed-effects models. Understanding the impact of masked BOs on inhibitory control and considering gender-specific effects will contribute to our comprehension of olfactory communication and its impact on cognitive performance.

Location: Cafeteria
Poster 47

Similar effects of past rewards and punishment avoidances on long-term memory attentional orienting

Samuel Suárez-Suárez, Kia Nobre, Socorro Rodriguez Holguin, Fernando Cadaveira, Sonia Doallo

Attentional orienting can be preferentially biased towards a spatial location in natural scenes associated to reward (Doallo et al., 2013) or punishment avoidance (Suárez-Suárez et al., 2019) in past encounters. However, it is still unknown if reward- and avoiding-punishment-based memory (LTM) are prioritized by the attentional system in a similar way. Here, in two independent experiments, participants performed an experimental paradigm that integrated contextual LTMs associated or not to successful avoidance of punishment (Experiment 1, $N = 32$) or to a positive reward (Experiment 2, $N = 32$) and orienting of attention within naturalistic scenes. Performance over the course of a learning task carried out in the first day (5 learning blocks) confirmed that participants were able to establish robust memories for the spatial locations at which target stimuli were presented. In the final (sixth) learning block, where motivational-associated outcomes were manipulated, no difference was found between avoidance-related (vs. safe) and rewarded (vs. nonrewarded) scenes either in search time or accuracy. Results from a visual orienting task performed 24h later showed that spatial expectations from LTM both paired with punishment-avoidance or positive reward conferred behavioral benefits, as revealed by more accurate responses to targets presented at remembered locations ($F(1,60) = 6.67$, $p = 0.012$). These findings indicate that acquired motivational value of specific spatial locations optimizes perceptual decisions in real-world environments and provide new evidence to elucidate the question of whether the brain encodes avoidance of an aversive outcome in a similar way as receipt of a reward.

Location: Cafeteria
Poster 48

The effect of cues and feedback on driving behavior and event-related potentials under visual distraction in young and older drivers

Melanie Karthaus, Edmund Wascher, Stephan Getzmann

Increased distractibility by competing stimuli is a source of danger, especially for older drivers. This experiment investigated whether performance impairments in the braking reaction when driving under distraction can be reduced by technical solutions such as cues indicating potential critical events or through (person-centered) feedback processes.

23 young ($M=22.8$) and 21 older ($M=68.6$) subjects completed a simulated driving task that required occasional braking responses under visual distraction and the inhibition of responses to the distracting stimuli. After an introductory lap (PRE), the subjects received short-term interventions (INT) in randomized order: (a) cues indicating potential braking responses, (b) feedback on their performance or (c) no intervention (control condition). While driving, behavioral and neurophysiological data (EEG) were measured.

Under distraction, the older group showed an increased slowing of the braking reaction time and a higher error rate in the braking reaction than the younger group, but also responded more to the interventions: Preceding cues led to significantly faster braking responses, but also more braking errors compared to the control condition. Feedback was associated with slightly shorter reaction times and lower error rates. Preliminary analyses of the neurophysiological data show that the EEG data (N2, P3b) correspond with the behavioral data, suggesting a reduced cognitive control of distracting stimuli in older drivers as well as differences in underlying information processing while driving under distraction.

The results provide important information for the development of age-specific measures to improve driving safety especially in critical traffic situations.

Location: Cafeteria
Poster 49

40 HZ VISUAL AND AUDITORY ENTRAINMENT IMPROVES COGNITIVE FUNCTIONS IN MIDDLE-AGED HEALTHY CONTROLS

Bahar Güntekin, Ayşenur Akan, Furkan Erdal, Harun Yırıkoğulları, Simay Alptekin, Esra Ünsal, İrem Yemeniciler, Elifnur Bingöl, Burcu Bölükbaş, Muhammet Reveha Attila, Rümeysa Duygun, Ebru Yıldırım, Sümeyye Özdemir, Tuba Aktürk, Mehmet Kemal Özdemir, Yasin Yıldırım, Hikmet Buse Kuloğlu

In Alzheimer's Disease mouse models, 40 Hz sensory entrainment has been shown to provide a neuroprotective effect. The present study, for the first time in the literature, aims to examine the effects of 40 Hz auditory and visual stimulation on cognitive functions of healthy middle-aged (45-60 years old) subjects and compare these effects to those of 40 Hz tACS.

Subjects were divided into three groups. Thirteen subjects received 40 Hz entrainment, seven received 40 Hz gamma tACS stimulation on the left temporo-parietal area, and seven served as the control group. Neuropsychological tests were used. EEGs were recorded at baseline, after one hour and ten days of application. In the entrainment group, 40 Hz and 10 Hz power spectra increased after one hour and ten days of entrainment compared to baseline ($p < 0.05$). The entrainment group demonstrated significant improvements in the verbal fluency test ($p = 0.002$), MMSE ($p = 0.040$), Stroop C-color score ($p = 0.021$), and visual memory immediate ($p = 0.001$) and delayed recall scores ($p < 0.001$). In the tACS group, visual memory immediate ($p = 0.026$) and delayed recall ($p = 0.019$) scores were significantly increased, along with MOCA scores ($p = 0.047$); only the visual memory delayed recall scores were improved in the control group ($p = 0.003$).

To the author's best knowledge, for the first time in the literature, the present study showed the positive effects of 40 Hz sensory entrainment on the cognitive functions of the healthy middle-aged group, opening possibilities for future clinical applications.

This study was funded by the Turkish National Science and Research Council (No. 122R056).

Location: Cafeteria
Poster 50

Activity within dorsal anterior cingulate cortex is modulated by error inevitability in the stop signal task

Krzysztof Bielski, Szymon Wichary, Magdalena Senderecka

Errors play an important role in our lives, enabling us to adjust behaviour. Since errors can be more or less inevitable, and consequently more or less significant, their impact on subsequent performance can vary in degree. Following the results of an EEG study on the increased amplitude of the error-related negativity (ERN) during the processing of more avoidable errors, we aimed to verify a similar relationship in fMRI data. For this purpose, we analysed fMRI data from 30 participants (young adults, aged 20 – 25), performing the stop signal task, and used the stop-response interval as the index of error inevitability. We extracted the averaged BOLD signal in uninhibited stop trials within four regions (dorsal, medial, ventral anterior cingulate cortex (ACC), and presupplementary motor area) known as ERN generators. Then, we identified the maximum activity following the commission of an error within the BOLD time-series as dependent variable in a mixed-linear regression model. Our results showed that the magnitude of activity within the dorsal ACC is indeed associated with the index of error inevitability: the more avoidable the error, the more increased its activity. Thus, our findings indicate that it is the dorsal ACC that encodes the significance of errors that vary in their degree of inevitability.

Location: Cafeteria
Poster 51

Unconscious perception free from criterion bias and memory failures.

Pietro Amerio, Axel Cleeremans

Consciousness research recently saw the rise of 2-Interval Forced-Choice tasks for measuring awareness of perceptual stimuli. Participants detect whether a stimulus was shown during the first or second time interval of each trial – in conditions in which their detection accuracy is at chance, experimenters infer observers to be unaware of the stimuli. This approach was recently employed to demonstrate that healthy humans can perform perceptual tasks on visual information they are unconscious of. This awareness measure was developed to sidestep the criterion bias problem, which is pervasive in consciousness research, but it was criticized because memory failures could reduce its sensitivity. In other words, observers might be aware of a stimulus but fail to hold it in working memory until they report about it. In turn, this could lead researchers to mislabel cases of mildly conscious perception as instances of unconscious perception. In this work we modify the approach above to minimize this risk – the two alternatives for detection are presented at the same time in two different locations of the visual field, allowing us to reduce the interval between stimulus presentation and report. This project will capitalize on this improved design to reassess the issue of unconscious perception of simple visual features. Additionally, we will track microsaccades as markers of spatial attention, to examine how the latter contributes to the observers' behavior. Results will be presented at the conference.

Location: Cafeteria
Poster 52

Associative visuo-motor learning using transcranial magnetic stimulation induces stimulus-response interference

Leslie K. Held, Emiel Cracco, Lara Bardi, Maggie Kiraga, Elio Cristianelli, Marcel Brass, Elger L. Abrahamse, Senne Braem

Classical conditioning states that the systematic co-occurrence of a neutral stimulus with an unconditioned stimulus can cause the neutral stimulus to, over time, evoke the same response as the unconditioned stimulus. On a neural level, Hebbian learning suggests that this type of learning occurs through changes in synaptic plasticity when two neurons are simultaneously active, resulting in increased connectivity between them. Inspired by associative learning theories, we here investigated whether the mere co-activation of visual stimuli and stimulation of the primary motor cortex using transcranial magnetic stimulation (TMS) would result in stimulus-response associations that can impact future behaviour. During a learning phase, we repeatedly paired the presentation of a specific colour with a TMS pulse over the motor cortex. Next, participants performed a two-alternative forced choice task where they had to categorize simple shapes and we studied whether the shapes' task-irrelevant colour (and its potentially associated involuntary motor activity) affected the required motor response. Participants showed more errors on incongruent trials for stimuli that were previously paired with high intensity TMS pulses, but only when tested on the same day. Using a drift diffusion model for conflict tasks, we further demonstrate that this interference occurred early, and gradually increased as a function of associated TMS intensity. Altogether, our findings show that the human brain can learn stimulus-response associations using externally induced motor cortex stimulation. Although we were inspired by the Hebbian learning literature, future studies should investigate whether Hebbian or other learning processes were also what brought about this effect.

Location: Cafeteria

Poster 53

Fast pupillary and auditory responses to high temporally modulated sounds suggest a human magnocellular auditory pathway for threat detection

Martina Trisia Cinca-Tomás, Emmanouela Kosteletou Kassotaki, Jordi Costa Faidella, Carles Escera, Judith Domínguez-Borràs

Neural models for emotional processing in vision suggest the existence of an ultrafast magnocellular route to the amygdala, which allows for efficient detection of threat and subsequent adaptive behavior in humans. This route is known to mediate coarse visual processing, eliciting differential responses to threat than other more fine-grained pathways. In the auditory domain, animal evidence suggests the existence of a similar route for threat detection, but it remains unknown in humans. We investigated, with fear conditioning, a procedure that depends on amygdala response, whether a magnocellular pathway to the amygdala, particularly sensitive to high temporal modulations, mediates auditory and pupillary responses to threat that may differ from a parvocellular pathway, sensitive to low temporal modulations. We recorded electroencephalography and pupillometry of 28 healthy participants while they detected voices. Voices were either paired (conditioned) or unpaired (not conditioned) with an unpleasant white noise, which determined their threatening significance. Results suggest that fear conditioning was effective, and threatening stimuli at high temporal modulations elicited earlier auditory and pupillary responses than those presented at low temporal modulations. In turn, early auditory threat responses to high amplitude modulated sounds correlated with response time in higher anxiety participants. These results are compatible with faster cortical responses to threat when encoded through magnocellular inputs to the amygdala, and suggest the existence of an auditory route for threat detection in humans, similar to that in vision.

Location: Cafeteria
Poster 54

Improving safety in human-robot collaborations: Identification of psychophysiological parameters of mental fatigue

Esther Semmelhack

Efficient human-robot collaborations require robots that can adapt to changes in the mental states of human users such as motivation, mood, or fatigue that might manifest in their performance. Our study focusses on user changes due to mental fatigue – a state that has been associated with slower reaction times, more errors, and accidents. It is proposed that fine-tuned motor movements are vulnerable to mental fatigue and are therefore a leading cause of accidents. To enable a dynamic assessment of the user's mental state, we aim to identify psychophysiological parameters of mental fatigue using electroencephalography (EEG) and eye tracking. We developed a version of a collaborative human-robot task setup to be performed under different levels of mental fatigue. This will be achieved by conducting a short and easy 2-back task on one day or a long and complex time-load dual-back task on a different day prior to the target task. The participants' performance in the task will be assessed by the precision and speed of their movement trajectories as measured by joystick movements. The effects of mental fatigue will be further quantified in the power and dynamics of EEG frequency bands and pupil size.

Location: Cafeteria
Poster 55

Linking pupil responses to Locus Coeruleus activities in rest and reactivity paradigms

Vivien Rabadan, Camille Ricou, Yassine Mofid, Nadia Aguillon-Hernandez, Claire Wardak

Pupil size provides an index of the locus coeruleus norepinephrine (LC-NE) system functioning. LC-NE, through its tonic and phasic activity, mediates arousal and optimises behavioural performance. Adaptive gain theory, which follows a Yerkes-Dodson curve, suggests that the LC-NE system plays an important role in controlling performance. Pupil diameter during a resting paradigm would reflect LC-NE tonic component, while LC-NE phasic component could be indexed by pupil reactivity to a target stimulus. The aim of our study is to characterize the link between tonic and phasic LC-NE activity indexed by pupil diameter by comparing rest and reactivity paradigms in the same subjects.

Pupil diameter was recorded with the Tobii pro-fusion eye tracker (250Hz) in thirty adults during a 3-min resting block and a face observation paradigm. Moreover, in order to test the integrity of the autonomic nervous system loop controlling pupil diameter, we also recorded pupil light reflex. We found no relationship between parameters recorded at rest (pupil median diameter and hippus parameters) and amplitude of the pupil light reflex.

Our preliminary results do not show any differences between the parameters recorded at rest (median, amplitude, frequency) and those recorded during the reactivity paradigm (median and median amplitude of the plateau). However, an expected correlation was found between the resting median and the pre-reactivity one.

Overall, the pupil did not allow us to characterise the link between tonic and phasic LC-NE activity. However, it would be interesting to test a reactivity paradigm that would allow greater activation of the LC-NE system.

Location: Cafeteria
Poster 56

Investigating causal contributions of the primary somatosensory cortex in the detection and retention of innocuous and nociceptive touch

Louisa Gwynne

The primary somatosensory cortex (S1) is widely cited as fundamental in detecting and transiently retaining tactile inputs. Numerous studies evidence the role of S1 in subserving the detection of both painless and painful touch. Furthermore, under a sensory recruitment hypothesis of working memory, S1 is said to temporarily retain information about innocuous touch to fulfil task demands, aid perceptual continuity and so forth. However, fewer studies have investigated the contribution of S1 in the temporary retention of nociceptive tactile inputs. Moreover, the predominant use of vibrotactile stimulation in investigations of S1 and tactile detection and retention is notable. In the current study, participants completed a series of transcranial magnetic stimulation (TMS) experiments assessing the role of S1 in the detection of painless electrotactile stimulation and, in the transient retention of painless and painful electrotactile stimulation. Participants completed a tactile detection task as well as a 2-alternative forced choice intensity discrimination task. On every trial, two different intensity electrotactile stimuli, separated by an interstimulus delay (ISD), were delivered consecutively to the index finger. During the ISD two single pulses of TMS were applied over the contralateral S1, Vertex or a control site at 300 and 600 milliseconds. Preliminary data shows a reduction in discrimination accuracy for both painless or painful tactile stimulation when TMS is delivered during memory retention over S1 but not at the control site or Vertex. This replicates previous research findings, verifying the role of S1 in tactile retention and further extends such findings to the electrotactile submodality.

Location: Cafeteria
Poster 57

Multisensory signals are a necessary anchor for the auditory pinocchio illusion

Marte Roel Lesur, Matthew Longo, Ana Tajadura-Jimenez

The way we perceive our body affects cognitive, social and affective experience and behavior. Sounds seem to contribute to body perception. In the auditory pinocchio illusion, participants show implicit and explicit changes in finger length perception after hearing an ascending tone whilst pulling their finger. In contrast to other body illusions, this one relies on an arbitrary non-ecological sound associated with the gesture. This peculiarity calls the question of whether it's driven by high level processes related to prior associations of the sound and growth, or if it's in fact driven by low level multisensory processes. We tested two experiments. First to assess whether the effect would be sustained when instead of pulling the finger, participants exclusively paid attention to it while the sound was played (i.e., without the involvement of additional somatosensory signals) which involve tactile, motor and proprioceptive signals in addition to sound; and second, across several multisensory conditions (pulling, stretching, and touching). Our findings show only explicit (questionnaire) changes in finger length for the attention experiment, while both explicit and implicit (length estimation) changes in all the multisensory conditions without major differences between them. These findings extend literature on non-visual bodily illusions, suggesting their specificity and need of body-related sensory signals to anchor the sound, and are discussed according to body perception theories.

Location: Cafeteria
Poster 58

A helping hand? Error correction by a co-actor does not influence post-error slowing

Bence Neszemélyi, Roland Pfister

Responses are usually slower after errors than after correct actions. Interestingly, this post-error slowing effect is eliminated if the agent is allowed to correct the errors, which indicates that error monitoring processes are influenced by the possibility of correction. We examined whether this is also the case when, instead of having to correct their own errors, participants can rely on someone else to do that for them.

Participants performed a sorting task in two experiments that differed in task difficulty. Four bins were presented on the screen and participants were instructed to open the one that corresponded to the category of the target item. To induce errors, we manipulated the spatial compatibility of the target item and the corresponding bin. In the help condition, sorting errors were corrected by a virtual hand that opened the correct bin when participants made a mistake. In the control condition, participants received no help.

Post-error slowing was observed in both experiments, but it was not affected by the help provided by the virtual co-actor, which stands in contrast with previously reported effects of self-correction. The results might indicate that agents feel that they cannot rely on others' contributions as much as on their own. The results are also consistent with an explanation that attributes post-error slowing to the inhibition of automatic corrective actions. According to this approach, our results could indicate that the effects of withholding the corrective action are not reduced by observing someone else performing the same action.

Location: Cafeteria
Poster 59

Addressee gaze direction and response timing signal upcoming response: evidence from behavioral and EEG experiments

Alexandra Emmendorfer, Judith Holler

Gaze is a prominent visual signal in face-to-face communication. Data from conversational analyses suggest that an addressee's gaze direction may be an early signal (preceding the speech) of the type of response they are planning to give to a question. Dispreferred responses (e.g. a 'no' in response to an offer) are more often preceded by gaze aversions—possibly to mitigate the face threatening nature of the response. Response timing also matters in conversation, with shorter gaps typically preceding preferred responses and longer gaps being indicative of dispreferred responses. Here we investigate the extent to which these two factors (individually and combined) allow perceivers to predict the nature of an upcoming response.

Participants view videos of short conversation fragments between two avatars (Questioner and Responder). Each fragment ends with a question, followed by a pause (Short: 333ms, Long: 1000ms). During this pause, the Responder averts her gaze, or maintains eye contact with the Questioner, before giving a response (Yes/No). Preliminary findings from a behavioral study indicate that participants indeed anticipate more "No" responses when the Responder averts her gaze before responding, and more "Yes" responses with maintained direct gaze. In an on-going EEG study, we hypothesize that both gaze and gap duration have predictive power and will modulate the N400, and explore whether their simultaneous manipulation leads to interactive or additive effect. The findings will contribute to our understanding of human multimodal face-to-face interaction, and the role of visual signals in navigating potentially face-threatening actions in conversation.

Location: Cafeteria
Poster 60

THE ROLE OF NEW VERBAL LABELS AND INNER SPEECH IN THE ACQUISITION AND EXECUTION OF NOVEL ACTIONS

Angelo Mattia Gervasi, Claudia Mazzuca, Claudio Brozzoli, Anna M. Borghi

Language and action are core human capacities with common anatomical bases and cognitive processes. Recent studies reveal that language (e.g., the use of labels) can impact both perception and action. In line with this evidence, we carried out a pilot study to investigate whether: associating new verbal labels with novel actions facilitates action learning and execution; interfering with inner speech impacts participants' ability to acquire novel actions. We, thus, divided 40 participants into four groups, and asked them to perform a motor task. For all groups, the task consisted of observing, learning, and executing an action with an object. While participants of the control group 1 observed, learned, and executed the action, participants of group 2 received labels for the actions. Instead, participants of groups 3 and 4 performed an articulatory suppression task (continuously repeating a syllable) either during action learning or during action-label associations. Our results show that labels (group 2) facilitate action learning (accuracy results) compared to all other groups and facilitate action planning (Reaction Times) and execution (Movement Duration) compared to the control group. However, interfering with inner speech through an articulatory suppression task does not impact participants' ability to acquire novel actions. Ratings about inner speech use show that the control group needs to use inner speech more than the other groups in order to drive their sensorimotor learning. After submitting the preregistration, we will deeply explore our hypotheses through two behavioral experiments in which kinematics parameters will be measured as well.

Location: Cafeteria
Poster 61

DECREASED EVENT-RELATED DELTA OSCILLATIONS DURING VISUAL ODDBALL PARADIGM MAY RELATED WITH COGNITIVE IMPAIRMENT IN UNDERGROUND COAL MINERS

Ebru Yıldırım, Samet Çelik, Bahar Güntekin

EEG event-related oscillations (EROs) methodology is used in evaluating cognitive functions. Event-related delta and theta oscillations are related to cognitive functions and increase during cognitive processes. The event-related delta and theta oscillations are affected by cognitive impairment and reduced in subjects with cognitive impairment. The physical and mental health of miners working underground deteriorate due to working conditions, but also, cognitive skills may affected. We aimed to investigate electrophysiological differences during the cognitive task by using the EEG-EROs in miners underground working in the present study.

EEGs of 20 miners underground workers and matched 20 controls (working in the above-ground) were recorded during the visual oddball paradigm. Event-related power and phase-locking analyses were performed for delta and theta frequency bands. The statistical analyses were run with repeated measures of ANOVA ($p < 0.05$). Group difference was marginally significant for the event-related delta phase-locking ($p = 0.092$). Miners had lower delta phase locking than controls. The Stimulus type*Group interaction was statistically significant for the delta phase-locking ($p = 0.028$). Miners had lower delta phase-locking during the target stimuli than controls. On the other hand, there were no statistically significant differences for the event-related theta power and phase-locking ($p > 0.05$).

Event-related delta responses are reduced parallel to cognitive impairment. The present study showed reduced delta responses during the visual oddball paradigm in miners. The decrease in event-related delta oscillations seen in mine workers at a young age not only may reflect the cognitive impairment but also may be a risk factor for neurodegenerative disorders that occur at old ages.

Location: Cafeteria
Poster 62

Task switching ability in healthy subjects with cognitive fatigue.

Arnaud Rabat, Anaïs Loiseau, Sami Mécheri

Rationale of this study:

Cognitive fatigue, associated with a subjective feeling (effort, drop in motivation and disengagement) and possibly a reduction in performance (increase in response times and/or errors), is implicated in many accidents related to human factor. At the same time, performers (e.g. soldiers) are often required to undertake prolonged operations in complex multitasking environments that impose task-switching constraints, incurring a cognitive cost. Here, we wondered whether task-switching ability could worsen in healthy subjects experiencing cognitive fatigue.

Methodological procedures and main results:

Thirty-six subjects performed a task-switching paradigm before and after a cognitive fatigue session (45 min of a Go-NoGo task) or a control session (45 min of watching a video). The 45 Go-NoGo task induced both a subjective fatigue and a greater failure of inhibition capacities correlated with the time on task ($p < 0.01$). Our task-switching paradigm reproduced classical results (i.e., switch cost: slower and more error-prone performance in switch trials). Although cognitive fatigue did not influence the switch cost, it led to an increase in error rates.

Main conclusions:

Cognitive fatigue seems to be responsible for a moderate failure of task-switching performance, affecting error rates. One perspective involves examining how cognitive fatigue would impact the switch cost by introducing shorter preparation time (100 ms) and considering a second factor, a sleep debt.

Location: Cafeteria
Poster 63

Visual perceptual learning is enhanced by training in the illusory far space

Antonio Zafarana, Carmen Lenatti, Laura Hunt, Munashe Makwiramiti, Alessandro Farnè, Luigi Tamè

Visual objects in the peripersonal space (PPS), are perceived faster than farther ones, appearing in the extrapersonal space (EPS). This shows preferential processing for visual stimuli near our body. Such an advantage should favor visual perceptual learning occurring near, as compared to far from observers, but opposite evidence has been recently provided from online testing protocols, showing larger perceptual learning in the far space. Here, we ran two laboratory-based experiments investigating whether visual training in PPS and EPS has different effects. We used the horizontal Ponzo Illusion to create a lateralized depth perspective while participants completed a visual search task in which they reported whether or not a specific target object orientation (e.g., a triangle pointing upward) was present amongst distractors. This task was completed before and after a training phase in either the (illusory) near or far space for one hour. In Experiment 1, the near space was in the left hemispace, whereas in Experiment 2 it was in the right. Results showed that, in both experiments, participants were more accurate after training in the far space, whereas training in the near space led to either improvement in the far space (Exp. 1), or no change (Exp. 2). Moreover, we found a larger visual perceptual learning when stimuli were presented in the left compared to the right hemispace. Differently from visual processing, visual perceptual learning is more effective in the far space. We propose that depth is a key dimension that can be used to improve human visual learning.

Location: Cafeteria
Poster 64

Testing the Effectiveness of Goal-Directed Predictive Processing Interventions Within the Prison Context

Tilia Linthout, Emilie Caspar, Pieter ven Dessel

Introduction: Recently, policy makers in Western countries have shifted their view from prison as a punitive setting toward a rehabilitative one. This shift has led to an increased demand for evidence-based psychological interventions, which are currently lacking. Two pivotal issues within the prison context are (lack of) impulse control among prisoners and stigmatization of prisoners by prison guards.

In light of the ongoing discourse about the diminishing practicality of psychological theories, we draw upon the goal-directed predictive processing (GDPP) theory. This theory serves as a foundation for promoting wanted behavior change. According to the GDPP theory, behavior results from automatically applying the belief that your behavior fits situationally relevant goals.

Methods: In the initial phase, we aim to assess the effectiveness of GDPP training to go/no-go training for impulse control. For stigmatization, we plan to assess the effectiveness of GDPP training against the training that is currently used in Flemish prisons, which involves psycho-education and roleplay.

Results: Results are pending, as the interventions are still in the development phase.

Conclusion: The findings of these studies will give us insights into the processes of change in impulse control and stigmatization and may contribute to the development of effective interventions, addressing pressing issues within the prison context.

Location: Cafeteria
Poster 65

Relevance acquisition through motivational incentives: Modeling the time-course of associative learning and the role of visual features

Francesco Grassi, Louisa Kulke, Alex Lepauvre, Anne Schacht

Associated motivational relevance influences neural and behavioral responses to symbolic stimuli similarly to inherently emotional visual stimuli. However, it remains unclear how relevance affects visual processing stages of perceptual encoding and attentional allocation, particularly considering the role of low-level visual features in relevance acquisition. Our study ($n = 48$) used an associative learning paradigm, manipulating the visual features of the stimuli but not the stimuli themselves. In a learning session pseudowords were associated with gain, loss, or neutral outcomes. This was followed by a test session involving an old/new decision task, with stimuli presented in either the same or a different font. During both sessions, event-related brain potentials as well as behavioral and pupillary responses were recorded. Relevance effects on stimulus encoding stages were dependent on the active evaluation of the associated relevance, as evidenced by P1 modulations observed in the learning but not in the test session. In contrast, relevance effects on attentional allocation stages (EPN) were observed in both sessions. Notably, these effects appeared to be insensitive to manipulations of low-level visual features. Furthermore, the most pronounced effects were observed for loss associations in the learning session and for gain associations in the test session. These results highlight the dynamic nature of motivational relevance effects, with differential modulations during acquisition and testing, as well as between earlier perceptual processing and later neural responses. Significantly, our study provides evidence that the attentional allocation stages of visual processing are not influenced by changes in low-level visual features of the stimuli.

Location: Cafeteria
Poster 66

Integration of perceptual signal, decision-time, and emotional states in the creation of perceptual confidence judgements

Catherine Culot, Wim Gevers

Metacognitive reports of confidence emerge from the integration of multiple cues derived from processing internal and external information. In perceptual tasks, two primary sources of information are the quality of the perceptual signal from sensory processing and decision time, reflecting the speed of the initial decision. Confidence tends to increase with less ambiguous signals and faster decisions.

This study investigates how emotional states interact with these cues in forming confidence judgments. Across three experiments, we conducted linear mixed model analyses to explore the contributions of perceptual signal, decision time, and emotional states (Experiment 1: induced anxiety, Experiment 2: induced sadness, Experiment 3: Major Depressive Disorder, MDD) in a perceptual metacognitive task.

Our findings confirm the integration of both sensory and decisional sources. Furthermore, we observe that emotional states influence the respective contributions of these cues to confidence creation. Negative emotional states (both anxiety and sadness) or suffering from MDD lead participants to rely more on external sensory evidence when forming confidence ratings.

Our results suggest that affective information can modulate the influence of sensory evidence on metacognitive judgments. Recent studies propose that this modulation may be linked to the interoceptive monitoring of physiological changes throughout the body.

Location: Cafeteria
Poster 67

Drift-diffusion modeling of attentional shifting during frustration: Associations with state and trait irritability

Nellia Bellaert, Peter J. Castagna, Christen M. Deveney, Mandy Rossignol, Michael J. Crowley, Wan-Ling Tseng

Irritability is a prevalent symptom across many mood and anxiety disorders that significantly contribute to interpersonal difficulties. Irritability is conceptualized as aberrant behavioral and emotional responses to frustrative nonreward, i.e., the emotional state induced by the failure to receive an expected reward. Past research investigating irritability have used a cued-attention task with rigged feedback, the Affective Posner Task (AP), to assess attentional shifting following frustrative nonreward. Previous studies have not been successful in linking differences in self-reported irritability to traditional AP metrics (i.e., reaction time, accuracy). Computational modeling, via the estimation of nuanced parameters reflecting latent cognitive processes, may improve our understanding of the cognitive mechanisms of irritability. This study aimed to apply the drift-diffusion model (DDM) to the AP to determine if DDM parameters are useful in discovering individual differences in irritability. A sample of 152 young adults ($M_{age} = 20.93 \pm 1.98$) completed the AP and self-reported state (i.e., during the task) and trait (i.e., over the past two weeks) irritability. Stepwise regression models were used to evaluate whether DDM parameters better predict state and trait irritability over traditional AP metrics. Higher state irritability was predicted by lower decision threshold during the frustration block, and larger decrease in the decision threshold parameter between non-frustration and frustration blocks, over traditional AP metrics. This indicates that higher state irritability was associated with an impulsive decision-making style (preferring speed over accuracy) during frustration. These findings suggest that decision threshold may serve as a cognitive marker for mechanism-based interventions aiming at reducing irritability symptoms.

Location: Cafeteria
Poster 68

Event-Related Spectral Perturbations differences analyzed in predictable-unpredictable tone sequences presented in a passive and active way.

Carlos M. Gómez

The present report analyzed the Event-Related Spectral Perturbations (ERSP) generated by an auditory oddball paradigm presented, passively and actively, to a sample of 32 healthy adults. Stimuli trains were composed of four tones of increasing or decreasing frequencies (standard:S), intermingled with the sporadic appearance of sequences ending incongruously (deviant:D). In the passive condition, the subjects should ignore the sounds, whereas, in the active, they pressed the up or down arrow on the keyboard depending on the last tone frequency, with different pitches in S or D trials. In the passive condition, only the early theta band was significant ($D>S$), whilst, in the active, delta, theta, alpha, and beta were significant ($D>S$) in the same latency. The active condition presented a higher Event-Related Synchronization (ERS) compared with the passive for both the S and D, in early delta and theta, and also in late beta and gamma, additionally to a higher Event-Related Desynchronization in early alpha and beta. The comparison computed between the S trials preceded by a D (DS) versus S trials preceded by another S (SS) showed an ERS increment in early theta for the DS trials compared with SS. These results reflect the activity associated with attentional and motor processes during comparisons between Active vs. Passive, S vs. D, and DS vs. SS. In early latencies, the ERSP increment would be involved in assessing tone sequence prediction violation or confirmation, whereas in later latencies it could be implicated in processing the predictive value of tones inside the trials.

Location: Cafeteria
Poster 69

Valence affects whether but not how fast attention is shifted – findings from natural and instructed attention shifts

Sahura Ertugrul, Louisa Kulke

In our daily lives, we frequently disengage attention from one thing to shift to another. This is often crucial in emotional situations, like when we need to look away from a car crash and call for help. The current set of preregistered studies (<https://doi.org/10.17605/OSF.IO/DX9YT> and <https://doi.org/10.17605/OSF.IO/MWGEG>) investigated the factors affecting disengagement of attention by combining eye-tracking and Electroencephalography.

The studies measured how participants shift their attention away (i.e., disengage) from images varying in emotional (positive, negative, neutral) and social (social, nonsocial) content. For this purpose, Study 1 instructed participants to always look away, while Study 2 let participants shift their gaze naturally without instruction. When participants were explicitly instructed to look away (Study 1), they took longer to disengage from central images with social than nonsocial content, $p = .006$, $d = .455$, but the emotional content did not affect saccade latency, $p = .127$. The Early Posterior Negativity significantly responded to emotional valence, $p < .001$. In contrast, when people voluntarily shifted attention (Study 2), the frequency of saccades was affected by valence and sociality, $p < .0001$ for both. However, the latency of saccades was also unaffected by the emotional content in the natural attention shift condition.

In short, the results suggest that emotional content affects disengagement from a stimulus, but once we decide to shift attention, the speed of the shift no longer depends on the valence.

Location: Cafeteria
Poster 70

Long-term effects of regulating negative affect through cognitive demand

Linda de Voogd

Controlling emotions can play a vital role in maintaining mental well-being. Indeed, individuals with anxiety-related disorders may experience difficulties in emotion regulation, for example, with regards to recall of aversive events. A large body of literature has shown that cognitively demanding tasks can reduce immediate negative affect. However, whether such tasks also lead to long-term reduction in negative affect related to events that happened in the past remains unclear. In three experiments, participants encoded negatively valenced images. In experiment 1, following these images, participants were instructed to either 1) immerse themselves into the scene, 2) reappraise the scene to decrease negative affect, or 3) execute a working memory task. In experiment 2 and 3, participants encoded the images but now paired with a description. Thereafter, they were prompted with the description and asked to recall the scene they saw earlier. Following the statements and recall of the scenes, participants were instructed to immerse, reappraise, or perform the working memory task. The following day, for all experiments, participants were prompted with the original scenes (targets) and new scenes (lures). We found immediate reduction in subjective arousal ratings following both the reappraise and working memory condition (no significant difference between them) compared to the immerse condition. However, 24h later, this reduction in subjective arousal was not significantly different from the immerse condition when prompted with the original scenes. These findings raise questions about the effectiveness of employing cognitively demanding tasks as an intervention to alleviate negative affect tied to emotional episodic memories.

Location: Cafeteria
Poster 71

Extrinsic Emotion Regulation Choice: The Role of Situational Factors

Yoav Haramati

When your friend feels bad, you may react to help them feel better. Your attempts to influence their emotions are known as Extrinsic emotion regulation (EER). Providing emotional support to others plays a significant role in everyday life. EER may involve diverse strategies that depend on individual differences and the situation at hand. Therefore, an important question is how situational and personal factors influence the choice of strategy and the psychological consequences regarding the provider. The current study consisted of eight texts that describe negative situations presumably written by another person. The situations varied in their emotional intensity and controllability degree. Participants were asked to write letters to provide support to the person who experienced a distressful situation. They were assessed on the extent to which they employed certain strategies, their perceived intensity and controllability of each situation, and their emotions before and after providing help. The findings revealed that participants reported a shift towards a more positive and less negative mood after vs. before providing support. Moreover, the use of reappraisal was positively associated with the perceived intensity of the situation. Specifically, in low-intensity situations, participants reported more use of reappraisal in low-controllable, compared to high-controllable situations. Conversely, in high-intensity situations, participants reported more use of reappraisal in high-controllable, as opposed to low-controllable situations. To our knowledge, this study represents the first exploration of the choice of strategies in EER across various intensities and controllability of situations, contributing to a deeper understanding of the mechanisms underlying ER.

Location: Cafeteria
Poster 72

Facial motor synergies as a low-dimensional embedding of the emotional experience

Luca Cecchetti, Demetrio Grollero, Giacomo Handjaras, Giada Lettieri

Studies on inferring others' emotions through facial expressions found that four latent configurations are shared across cultures and can convey various emotions (Jack et al., 2016). Building upon this, we hypothesize that linguistic descriptions of one's affect converge onto the same facial display. Using an emotion elicitation paradigm, we test whether facial motor synergies act as a low-dimensional embedding of the subjective emotional experience. We marked and recorded the faces of 16 participants (10F, 27.7 ± 2.5 yrs) watching 1,096 emotionally-laden videos. Individuals were instructed to annotate changes in affect and summarize their experience using free descriptions. Facial synergies were obtained by estimating the markers' pairwise distance in a window time-locked to the emotion onset. To reveal latent patterns of facial configurations and how they relate to affect, we first employed a KNN classifier to predict participants' experience from facial displays and then applied spectral clustering to the obtained confusion matrix. Of all pairings of descriptions, 20% are classified from facial expressions with 75% accuracy or higher. States with opposite valence are more easily distinguished, yet classification is possible even for emotions sharing similar valence (admiration-tenderness: 81.7%). Importantly, we demonstrate the existence of four latent facial configurations, each associated with a large set of states (e.g., latent 1: astonishment, fear, admiration). This evidence corroborates the hypothesis that facial expressions represent a low-dimensional embedding of the subjective experience rather than mapping one-to-one to specific states. Our results, thus, suggest that the face tells about one's emotions less than what the words can do.

Location: Cafeteria
Poster 73

Loneliness and neurophysiological responses to affective stimuli - an investigation using electroencephalography and noninvasive brain stimulation.

Marta Chrustowicz, Szymon Mąka, Łukasz Okruszek

The Evolutionary Theory of Loneliness (ETL) proposes that prolonged loneliness can heighten vigilance to social threats and diminish emotional regulation in individuals. Previous studies have confirmed that the dorsolateral prefrontal cortex (dlPFC) is causally involved in downregulating the response, and that increasing activity of the left dlPFC may increase automatic control over social threats, while the right dlPFC stimulation may enhance the efficiency of the cognitive reappraisal (CR) technique. The current study aimed to explore the interactive effects of loneliness and noninvasive brain stimulation on the capability to utilize CR.

106 young adults (including 49 lonely and 57 non-lonely individuals based on the UCLA-R Loneliness Scale), were invited to participate in two experimental sessions, during which they were subjected to either anodal (active 2 mA) or sham direct current stimulation over the right dlPFC (n=54) and left dlPFC (n=52). Upon completion of the stimulation, participants were asked to perform a cognitive reappraisal task based on pictorial stimuli, while their electroencephalography was recorded.

In line with our expectations, we observed the anticipated effects of the affective content of the stimuli (negative > neutral) and the use of reappraisal strategies (reappraise < observe) on the behavioral and neural markers recorded in participants. Participants rated the stimuli as significantly more arousing in the sham condition than in the anodal stimulation condition. However, contradictory to the ETL claims, participants' loneliness levels were not associated with the outcome variables

Location: Cafeteria
Poster 74

Skin conductance response to facial expressions and words for emotions

Liina Juuse, Diina Tamm, Kaidi Lõo, Jüri Allik, Kairi Kreegipuu

Skin conductance response (SCR) is a reliable indicator of sympathetic activation used to measure emotional arousal. We examined the extent to which emotional discrimination is influenced by the modality of presentation. SCR amplitudes for 102 participants (42 men, 18–49 years, $M = 25.16$; $SD = 6.51$ years) were recorded using the Continuous Decomposition Analysis (CDA). They were presented with six basic emotions—anger, happy, disgust, fear, sad, and surprise—conveyed by facial expressions or emotion words. The amplitude of SCR was accurately predictable from the subjective arousal ratings, while valence did not play a significant role. Employing an exponential decay function ($e^{(-\lambda(t-\tau))+\alpha}$), the habituation process to emotional and neutral stimuli over six consecutive presentations was shown, illustrating the gradual decrease in SCR response relative to the preceding trial of the same stimulus. By subtracting the response to neutral stimuli from the emotion-evoked SCR, it was shown that each first presentation of emotion has a sizable answer, which was produced by the emotional content. The initial emotional response to happy ($t(6424) = 4.35$, $p < .001$), disgust ($t(6424) = 3.11$, $p = .002$), and sad faces ($t(6425) = 2.34$, $p = .04$) surpassed that evoked by words conveying similar meaning. The results highlight that emotions can be quantified using a simple electrical instrument, emphasizing the potential of SCR to offer insights into emotional processing.

Location: Cafeteria
Poster 75

The Relationship between Interoception, Olfaction, Emotion, and Dissociation

Beth Longley, Sarah Garfinkel

Sensory processing enables us to integrate information from our surroundings and ourselves in order to successfully navigate the world, connect to our body, and experience emotions. Alexithymia (difficulty detecting and identifying feelings) and dissociation (detachment from ourselves or the world) are common transdiagnostic mental health symptoms, thus investigating how our senses influence such symptoms may provide insight into mental health conditions. The ability to detect our heartbeat (cardiac interoception) is related to emotional experience, and poor olfaction is associated with mental health conditions such as depression. However, it remains unclear exactly how sensory processing relates to emotion and dissociation, as self-reported beliefs about certain senses do not necessarily align with true task performance. We investigated how cardiac interoception and olfaction relate to alexithymia and dissociation across behavioural measures (accuracy), self-reported subjective measures (confidence, belief), and metacognitive awareness (insight). Participants (N=154) completed the Heartbeat Discrimination Task, the Sniffin' Sticks Test of olfaction, the Toronto Alexithymia Scale, and the Cambridge Depersonalization Scale. Multiple linear regressions revealed that interoception was not significantly related to alexithymia or dissociation. Self-reported beliefs about olfaction negatively predicted alexithymia and dissociation, suggesting that individuals who believe their sense of smell is poor have difficulty identifying feelings, connecting to their body, and recalling memories. Results highlight the relevance of olfaction in emotion and dissociation, and the importance of assessing the subjective experience of senses alongside behavioural measures of accuracy. Future research may explore whether these senses differ in clinical populations, and whether targeting sensory modalities may improve mental wellbeing.

Location: Cafeteria
Poster 76

Whose emotion is readable from the face?

Eneli Veltmann, Liina Juuse, Kairi Kreegipuu

Human beings are inherently social, deriving pleasure from interpersonal communication. Research indicates that individuals facing challenges in having their emotions accurately perceived, receiving the desired responses, or having their emotional states acknowledged, encounter elevated stress levels, which in turn increases the risk of mental disorders. We asked whether and how negative and positive affect, extroversion and neuroticism, and task-confidence predict the intelligibility of the expressed emotion to others. In an online experiment, 121 respondents (24 men, mean age 31.86 years; SD = 14.13 years) rated 300 video clips expressing emotions (fear, joy, disgust) presented by 100 (39 men, mean age 24.87 years; SD = 6.40 years) models. The raters provided answers to the video clips from among basic emotions (fear, sadness, joy, disgust, anger, surprise). In logistic regression (for fear, joy, disgust, and unspecified emotions), extroversion, and the model's confidence rating on the intelligibility of the expressed emotion remained statistically significant but weakly associated with emotion recognition accuracy. Neuroticism was significant only in predicting recognition of disgust, and positive affect only in the unspecified model and in predicting disgust. The research helps to understand the relationship between personality, affect and self-confidence assessment with the accuracy of emotion recognition and offers opportunities to take these aspects into account in the promotion of mental health.

Location: Cafeteria
Poster 77

Awareness is determined by emotion and gender

Marta Poyo Solanas

Consciousness studies tend to overlook the role of specific information in reaching subjective awareness. Recent research has already shown that affective images might be prioritized, but substantial distinctions exist within this category, impacting behavioral outcomes. The present study investigated whether the specific emotional expression but also the gender of the stimuli and of the participants impacts awareness. For this purpose, a visual masking paradigm was utilized presenting a body expression for 8ms followed by a 16ms mask, with participants (N = 45) indicating whether they perceived the target stimulus. Visibility ratings and reaction times were analyzed for emotion (anger/fear/sadness), stimulus gender (female/male), participant gender (female/male), and presentation orientation (upright/inverted). Our results showed that participants' awareness responses reflect differences in the emotion expressed, that these differences are a function of the gender of the stimuli as well as of the gender of the participants and, finally, that minimal awareness is likely to be associated with emotion specific features of the body image. Particularly, we found that threatening body expressions are more readily detected than fearful postures, especially by males presented with male stimuli. These visibility patterns persisted regardless of stimulus orientation, indicating that minimal awareness is driven by emotion-specific features of the stimuli. Our findings underscore the importance of affective factors for theories of awareness and also underscore the clinical significance of gender differences in emotional processing, often overlooked in standard face and body emotion recognition studies.

Location: Cafeteria
Poster 78

Emotional Dynamics in Photojournalism: Unraveling the Impact of Individual Sensory Processing Sensitivity on Perception and Attention.

Beata Pacula, Agata Szymańska, Joanna Pilarczyk, Michał Kuniecki

Photojournalistic images can convey a powerful message, shaping our understanding of the world; and emotions play a critical role. Understanding the perception of emotions in photojournalistic images is crucial, especially considering individual differences in emotional reactivity, like Sensory Processing Sensitivity (SPS).

In our previous study, we established that people scoring higher on SPS evaluated emotional stimuli higher on arousal, and more extremely on valence. Importantly, SPS also influenced visual attention: highly sensitive persons fixated less on the key objects in negative images.

In the current study, we aimed to explore whether the observed bias extends beyond artificially chosen stimuli.

We selected 1000 contemporary photojournalistic photographs from the European Press Agency database, depicting a variety of worldly events affecting the lives of people and societies. 600 participants were asked to evaluate photos on the valence and arousal dimension using the Self-Assessment Manikin Scale (Bradley & Lang, 1994) and to assign the emotions they felt while viewing a photo (following Azevedo et al., 2020). Finally, participants' Sensory Processing Sensitivity was measured using the Highly Sensitive Person Scale for research purposes (Aron & Aron, 1997).

People scoring higher on SPS evaluated photos as more arousing. No differences in emotional valence were observed, however, highly sensitive persons reported more often feeling Anger, Compassion, Fear, Pain, Regret, Sadness, Tenderness, and Hope.

Our next stage is the eye-tracking study to examine whether attention patterns and emotion-related physiological reactions to the photos could be - similarly as for the emotional pictures - modulated by SPS.

Location: Cafeteria
Poster 79

The influence of haptic devices on threat perception of a human avatar in a virtual reality scenario

Sophie Kühne, Anatole Lecuyer, Vojta Smekal, Nicole Occidental, Jeanne Hecquard, Beatrice de Gelder

This study investigates the influence of haptic feedback on threat perception using virtual reality (VR). Threat perception is an important skill for survival. VR gives us the possibility to create a threatening situation and investigate its effects while being fully safe for the participant. The experiment used a haptic device in form of a tightening belt in order to influence the feeling of proximity of the threat. During the study participants viewed two different scenarios of a human approaching with either a neutral or an angry stance, while wearing the belt. The belt either tightened or stayed still during the scenario. The belt tightened at three different speeds. The participant pressed the space bar, when they felt uncomfortable during the scenario. An overall significant effect was found for the haptic and emotion condition and the interaction between both. For the haptic factor the haptic feedback led to a faster response time (RT) and for the emotion factor the angry emotion also led to a faster RT. In the trials with haptic feedback there was a significant effect of the wrapping speed of the belt. Overall, this study shows that the emotional stance of the avatar has an effect on the threat perception and that the tightening of the belt influences how fast participants felt uncomfortable.

Location: Cafeteria
Poster 80

Control = Ego Boost? The Impact of Stressor Controllability on Affect, Behavior and Self-Esteem

Jana Meier, Laura E. Meine, Michèle Wessa

Controllability of negative events is an important determinant of their consequences. While experience of uncontrollable stressors may contribute to the development of depression, control over aversive stimuli may provide a resilience mechanism.

Protective stressor controllability effects have been demonstrated in humans, but accurate translation of the original animal studies remains a challenge. We aimed to replicate and improve a paradigm developed by Meine et al. (2020) to assess the effect of control over stressors on affective responding, escape behavior and self-esteem. A deficit in self-esteem following uncontrollable stress could corroborate the link between stressor controllability and depression.

125 healthy participants were assigned to three groups: A controllable group (CON) was exposed to aversive stimulation (non-painful electrical shocks, white noise) that could be terminated by completing a simple task. A yoked uncontrollable group (UNCON) received the same amount of uncontrollable aversive stimulation. A no-stress control group (NO-STRESS) received no aversive stimulation during this task. Affect, subjective stress, controllability and helplessness were assessed. Subsequently, all groups underwent an escape behavior task with aversive stimulation and a self-referential encoding task measuring self-esteem.

We expect the UNCON group to show more negative affect, worse escape behavior, and lower self-esteem compared to the CON group. Preliminary results show that UNCON perceived less control and more helplessness. Data analysis is pending.

We hope to bridge findings from animal literature with those from human stressor controllability research. Improved understanding of the mechanisms that mediate protective effects of control is relevant for interventions that foster resilience against depression.

Location: Cafeteria
Poster 81

‘It’s a Kind of Magic’: Exploring Multisensory Modulation of the Sense of Self Through Bodily Movements in Depersonalisation

Simon Knogler

Background: Dynamic integration of exteroceptive and interoceptive bodily signals is a fundamental aspect of self-consciousness (Park & Blanke, 2019). Depersonalisation (DP) is a condition that profoundly disrupts self-consciousness, making people feel detached from their self and body, and living in one’s head (Sierra & Berrios, 1997). We conducted an in-person experiment looking at the spontaneous coupling of auditory self-related sensory feedback (i.e. footsteps) with the cardiac cycle in participants with DP experiences.

Methods: 60 participants with high ($N=30$) and low ($N=30$) occurrences of DP as measured by the Cambridge Depersonalisation Scale (CDS) performed the Magic Shoes task (Tajadura-Jiménez et al., 2015) which is designed to measure the modulation of bodily self-representations. We also monitored participants’ heartbeats using a portable cardiac monitor and tracked their gait mechanics with an accelerometer.

Results: We found that, independently of the sound condition and controlling for weight differences, high DP individuals were accelerating faster than low DP individuals, $F(1, 56.004) = 4.23025$, $p = 0.044379$. Also, using circular statistics, we examined the distribution of gait events — Initial Contact (IC) and Toes Off (TO) Events— within designated periods corresponding to systole and diastole of the cardiac cycle. We found that TO events were significantly coupled with the systole phase in both the high DP ($M=0.529$, 95% CI [0.501, 0.557], $t(29)=2.11$, $p=.043$) and the low DP group ($M=0.539$, 95% CI [0.512, 0.565], $t(26)=3.02$, $p=.006$)

Conclusion: Our results suggest a general phase synchronization between footsteps and heart beats regardless of (dis)embodiment.

Location: Cafeteria
Poster 82

Self and Other in Body Perception. An ERPs study.

Juanzhi Lu, Lars Riecke, Brenda E. Ryan, Beatrice de Gelder

This study investigated the neural basis of integration of body and face information into person identity. Participants were first immersed in a virtual reality (VR) environment in which they controlled an avatar performing physical exercise tasks. The body and face of the avatar were either consistent (realistic identity condition resembling the participant or another person) or inconsistent (unrealistic identity condition resembling a mixture of the two, that is, (participant's body with someone else's face, or someone else's body with participant's face)). Following the VR task, participants passively viewed the avatar (varying in body orientation and dress color) while their neural responses were measured with electroencephalography (EEG). Analysis of event-related potentials (ERPs) revealed that avatars with consistent body and face elicited larger N170 and vertex positive potential (VPP) than inconsistent avatars. Our results show that N170/VPP are sensitive to body-face consistency, indicating that integration of body and face information into person identity occurs rapidly in the early stages of face and body perception.

Location: Cafeteria
Poster 83

Social Support Influences the Malleability of Body Perceptions

Amar D'Adamo, Angel Sánchez, Ana Tajadura-Jiménez

Mental body representations are malleable in response to sensory cues, including auditory cues. In the “footsteps illusion”, real-time alteration of the sounds people produce as they walk lead to perceptions of being lighter/heavier, quicker/slower, more masculine/feminine, and in turn evoke behavioral and physiological changes, including emotional changes. Body illusions are known to affect social attitudes towards others, but there is a research gap on the social influence on the malleability of body perceptions. We investigated whether the malleability of body perceptions is modulated by individuals' social support networks. We employed the auditory “footsteps illusion” to specifically focus on changes in perceived body weight, which is specially relevant in this context given the social stigmas associated with weight. Leveraging a sample of 104 people, we explored the effects of three filtered footsteps' sound conditions (low-frequency, high-frequency and control) on body-weight perception. We collected and analyzed extensive data (demographics, behavior, physiology, psychology, subjective experiences). Participants filled in questionnaires on body image satisfaction and eating disorders, given prior reports on different effects of the footsteps illusion according to eating disorder symptomatology. Results show that the number of people composing the participants' support network is positively correlated to body image satisfaction, and negatively correlated to eating disorders symptomatology. A significant interaction between sound condition and social support networks parameters indicated a stronger body illusion for participants with a smaller social support network. Our findings suggest that social support networks shape body perception, and call for better understanding of the mechanisms underlying these effects.

Location: Cafeteria
Poster 84

Cardiac responses to sounds reveal the embodiment of sleep functions

Matthieu Koroma, Paradeisios Alexandros Boulakis, Federico Raimondo, Christine Blume, Mélanie Strauss, Jonas Beck, Christina Schmidt, Björn Rasch, Athena Demertzi

Cardiac signals, often recorded in cognitive studies during sleep, are typically neglected from analyses. We advocate here that they contain meaningful information about sleep functions. To do so, we demonstrate that cardiac responses to sounds hold valuable and irreducible information about stimulus processing during sleep. We first analyzed two datasets (<https://doi.org/10.1073/pnas.1501026112> and <https://doi.org/10.1093/sleep/zsac199>) presenting an auditory local-global paradigm – a modified version of the classic oddball – during sleep. We show that cardiac activity accelerates to local deviants (corrected Wilcoxon test: $z=-0.27$, corrected $p=0.029$) in NREM sleep and decelerates to global deviants ($z=0.26$, corrected $p=0.038$) in REM sleep. This double dissociation between complexity levels of error detection across sleep stages diverge from previously reported magnetoencephalographical and electroencephalographical findings. Second, we analyzed a study showing that presenting relaxing words during NREM sleep induce a deeper sleep and a better sleep quality (<https://doi.org/10.1093/sleep/zsab148>). We found that cardiac activity slows down upon hearing relaxing (17.5ms, $p=0.037$), but not control words (-4.6ms, $p=0.561$, relaxing vs. control: $z=0.29$, $p=0.040$). We also show that cardiac signals contribute independently to sleep modulation compared to cerebral signals (part of variance explained without ECG:18% vs. with ECG:28%, model comparison test: $p=0.030$). We further promote our approach by freely sharing our methodology as a tutorial on Gitlab (https://gitlab.uliege.be/Matthieu.Koroma/cardiac_relaxation_beck) with data available at OSF (<https://osf.io/jn7ar/>). Overall, our results offer new empirical evidence supporting the embodied nature of stimulus processing during sleep. They also highlight the relevance of including cardiac signals in our understanding of sleep functions and their modulation by sensory stimulation.

Location: Cafeteria
Poster 85

Can people see heartbeats in the faces of others

James Kilner, Alex Galvex-Pol

Previous research has shown that subtle visual cues time-locked to heartbeats are present in people's faces and constitute an exteroceptive source of information about their interoceptive states. However, this does not ensure that observers are able to perceive and integrate these minute changes to access information about others' cardiac rhythms. The relevance of this ability lies in its potential role in successful social interactions, as it may support key elements such as Theory of Mind. Indeed, the perception of external signals about the interoceptive states of others could facilitate their simulation in the observer's body allowing shared cardiac dynamics between individuals while providing an understanding of their mental states based on the most likely causes of the feelings experienced within one's own system. To address the uncertainty in people's ability to detect cardiac effects in others' face, here we ran a series of experiments that required participants to watch videos of actors together with a visual signal, and to judge either whether or not the signal was simultaneous with the actors' heartbeats solely by looking at their faces or to estimate the heart rate of the actor. Here we show that (i) some participants are able to perceive cardiac-related cues in actors' faces, and that this ability may also depend on the arousal of the person presented to them and (ii) people concisely modulate the estimated heart rate of other people and that this is dependent upon their own heart rate and the perceived health and anxiety of the actors.

Location: Cafeteria
Poster 86

Mechanisms of interoceptive-exteroceptive integration during cardio-audio synchrony

Matthieu Koroma, Kevin Nguy, Andria Pelentritou, Marzia De Lucia, Athena Demertzi

Interoceptive-exteroceptive integration can happen via different mechanisms, i.e. predictive processing, active inference or dynamical coupling. In this preregistered study, we are testing which mechanisms support interoceptive-exteroceptive stimulus integration during cardio-audio synchrony.

To do so, we ran two experiments using the same within-subject 2x2x2 factorial block design. We recorded reaction times (behavioral, $n=10$) and multi-modal physiological responses (physiological, $n=40$; EEG, ECG, EMG, EDA, respiration, pupil size) to deviants that varied in terms of a) cardio-audio synchrony (synchronous or asynchronous), b) type of deviation (rare tone or omission) and c) predictability (regular or random). Interoceptive abilities were assessed with the FR-MAIA questionnaire and discrimination questions between synchronous and asynchronous conditions.

The behavioral experiment revealed that reaction times depended on deviants' type ($\beta=0.07$, $p<0.001$) and regularity ($\beta=0.22$, $p<0.001$) with an interaction between both ($\beta=-0.16$, $p<0.001$). No effect of synchrony ($\chi^2=2.66$, $p=0.62$) nor interoceptive abilities ($\chi^2=3.86$, $p=0.43$) were found. Physiological results including event-related potentials, cardiac, pupil, respiratory and EDA responses will be analyzed and compared to pre-registered hypotheses to decipher the mechanisms supporting cardio-audio synchrony at the physiological level.

By testing how the body, the brain and the environment are integrated into behavior and physiological signals, we aim at providing a better understanding of the mechanisms involved in self-related perceptual processes during wakefulness. Results obtained will inform studies investigating their preservation in non-communicative states of consciousness, such as sleep and disorders of consciousness.

The data supporting results will be available from OSF (osf.io/6fvuw) and the code from Gitlab (<https://gitlab.uliege.be/Kevin.Nguy/giga-crc-cardio-audio-expe>).

Location: Cafeteria
Poster 87

Complementary human-avatar joint actions re-map visuo-tactile integration and abolish visuo-tactile interference effects

Giovanna Cuomo

Studies indicate that the well-established visuo-tactile interference effects (i.e., the interfering effect of spatially incongruent visual and tactile stimuli presented simultaneously) observed within the peri-personal space (PPS) (e.g., light near the index and tactile stimulus on the thumb) are expanded to visual cues appearing at locations outside the PPS when individuals plan to grasp objects at those locations and when they observe another individual performing actions toward either personal or shared objects. However, these effects have not yet been studied in real-time interactive contexts. In three experiments we investigated whether these visuo-tactile effects are modulated when coordinating with a partner during joint actions. Participants were asked to grasp a bottle-shaped object on two target locations synchronously with an avatar by predicting its movement and performing opposite/same actions to those of the partner (Free condition) and to detect a tactile stimulus on their finger(s) while spatially in/congruent visual cues with their movements appeared on the partner's object. In a control condition (Guided), participants were asked to detect the tactile stimuli while synchronizing with the partner by knowing in advance what action to perform. The classical interference effect of spatially incongruent visual cues on the detection of a tactile stimulus was selectively abolished when participants had to predict the partner's movements while performing opposite actions. This result was replicated in three different studies showing evidence that visuo-tactile integration is modulated according to the rules of interpersonal interactions hinting at the possibility that the PPS is re-mapped in a shared interaction space.

Location: Cafeteria
Poster 88

Individual differences in intracortical inhibition predict action control

Thomas Quettier, Giuseppe Ippolito, Laura Lenzi, Pasquale Cardellicchio, Simone Battaglia, Sara Borgomaneri

Cognitive neuroscience has extensively explored the complex ways in which implicit emotional processes shape cognitive behaviors. For instance, how a subliminal perception of a threat can accelerate a person's response to a subsequent stimulus without their conscious awareness. Building on this intrigue, our study investigates the role of intracortical inhibition in action control, specifically examining its modulation under the influence of implicit emotional priming. By exploring this dynamic, we aim to uncover how subtle, non-conscious emotional cues, like a fleeting glimpse of a fearful expression, can impact an individual's ability to regulate motor responses. We engaged 46 right-handed individuals in a modified Stop Signal Task (SST), assessing their response inhibition in the presence of subliminal fear and neutral stimuli. Short-Interval Cortical Inhibition (SICI) and Intracortical Facilitation (ICF) were measured to understand their correlation with the Stop Signal Reaction Time (SSRT). Our findings demonstrate that subliminal fear priming significantly alters SSRT, resulting in faster inhibitory responses compared to neutral conditions. Notably, SICI, but not ICF, exhibited a positive correlation with SSRT across different conditions. This indicates that GABAergic activity, as reflected in SICI, can independently predict motor inhibition performance, irrespective of other systems like emotional processing. This research contributes significantly to cognitive neuroscience and psychology, highlighting how subliminal emotional stimuli, particularly fear, influence cognitive control as measured by SSRT. The findings challenge existing models by underscoring the complex interaction between implicit emotional processes and response inhibition and highlight the independent role of SICI in predicting motor inhibition.

Location: Cafeteria
Poster 89

Neurophysiological basis of the relationship between interoceptive attention and emotional recognition.

Claudia Pizarro, Mónica Toro, Francisco Ceric

Internal bodily processes orchestrate a symphony of signals that the brain swiftly interprets, giving rise to an instantaneous monitoring of the internal bodily state—an intricate dance known as interoception, distinct from the external signal-oriented attention known as exteroception. Our overarching goal is to determine the relationship between attentional regulation (interoceptive and exteroceptive) and emotional recognition.

A cohort of 76 participants engaged in three distinct emotional recognition tasks. Behavioral and EEG measures were captured during activities that emphasized interoceptive and exteroceptive attention, alongside a control group with unrestricted attention. Behavioral assessments included accuracy and reaction time analyses, while EEG potentials related to attentional recognition events were scrutinized.

At the behavioral level, we found statistically significant differences in accuracy ($H(2) = 8.28, p < .05$) between the group without attentional focus ($Mdn = 0.94, IQR = 6$) and the exteroceptive ($Mdn = 0.90, IQR = 9.18$) and response time ($F(2,44.6) = 4.23, p > .05$) where the control group ($M = 814, SD = 181.4$) was slower than the interoceptive group ($M = 713, SD = 85.2$) and the exteroceptive group ($M = 687, SD = 153.6$). At the physiological level, EEG distinguishes between interoceptive and exteroceptive attentional processes at the early level ($P100$) for the emotional face recognition task ($F(2,4) = 2.86, p < .05$).

The group without attentional focus showcased heightened accuracy in their responses compared to the exteroceptive-focused group at the behavioral level. The intricate interplay between emotion and interoception is modulated by attention, particularly during the nascent stages of perceptual processing, as underscored by EEG findings.

Location: Cafeteria
Poster 90

Data-driven features of human body movements and their neural correlates

Vojtech Smekal, Marta Poyo Solanas, Beatrice de Gelder

When observing a person performing an action, for instance kicking a ball, the brain is tasked with interpreting the incoming visual information from the retina to ultimately assign a high-level cognitive label to the perceived action. To do this, it has been proposed that the brain computes an intermediate step – behaviourally relevant mid-level features (de Gelder & Poyo Solanas, 2021). In the past, investigations of such mid-level features have focused on features defined based on the literature, such as limb contraction. Complimentary to these past approaches, here we use coordinate data from recorded human whole-body movements to define such mid-level features based on the movements themselves and use fMRI to investigate their relevance to the brain. Specifically, we presented 20 participants in a 3T MR (voxel size = 2mm isotropic, TR = 1300ms) scanner with 1s videos of six actors performing six different actions (self-protecting, greeting a friend, expressing frustration, brushing off, peeling a banana, searching for an object). We also used hierarchical clustering (HC) and sparse principal component analysis (sPCA) to define features of the movements based on tracking 25 key points mapped onto the actors' bodies. We find systematic relationships between the data-driven features of human body movements and brain regions previously implicated in body and action processing.

Location: Cafeteria
Poster 91

The default mode network emerges from message-passing dynamics in human structural connectomes

Marlis Ontivero Ortega, Eduardo Martínez-Montes

Understanding how functional networks emerge from the structural organization of the brain is essential for studying its structure-function relationship. Specifically, the autonomic Default Mode Network (DMN) is a resting-state sub-network that is active in almost all physiological brain states (i.e., is central to cognition), and arises from the functional dynamics of the brain's structural connectome (SC).

Here, we validate a neural message-passing model (Belief-Propagation (BP) and Susceptibility-Propagation (SP) algorithms) to describe the macroscopic resting-state functional activity of the brain based on individual SCs (n=70). Group ROC sub-network analysis over the activation maps obtained with BP showed that the DMN had the highest mean AUC, and was the only one significantly different to all others. The long-range correlation matrices estimated by SP can predict the sub-networks labels using the connectivity pattern of each region as features. The DMN was the best predicted.

The DMN results were replicated in another dataset: healthy controls (n=27) and schizophrenia patients (n=27). However, there was a significant difference in the critical temperature of the dynamic system between patients and controls, suggesting some brain reconfiguration.

These results are promising to further investigate the physiological role of the DMN and the structure-function relationship of the brain not only at rest but also during cognitive processes. This validation is also crucial for a deeper understanding of neural connectivity changes in pathological data (e.g. affective and age-related disorders). Finally, the neural message-passing model will be interesting to address the causal relationship between anatomical and functional changes.

Location: Cafeteria

Poster 92

Fingerprints of Psychiatric Symptoms in the Stomach-Brain Axis

Leah Banellis, Ignacio Rebollo, Nii Nikolova, Micah Allen

Pioneering research on brain-body interactions has revealed the existence of functional coupling between the rhythmic activity of the stomach and brain. While major breakthroughs support a pivotal role of the gut in psychopathology, the mental health implications of this recently discovered stomach-brain axis are unknown. We hypothesised that stomach-brain coupling in transdiagnostic cortical networks would index individual differences in mental health, in particular with anxiogenic factors. We estimated stomach-brain coupling by combining functional brain imaging with electrogastrography in the largest study to date, involving 199 individuals. To assess a spectrum of psychiatric dimensions, we sampled participants exhibiting a distribution of symptoms from subclinical to clinically significant. We then utilised multivariate prediction techniques to estimate stomach-brain fingerprints indexing these mental health profiles. We observed a robust, cross-validated stomach-brain fingerprint indexing psychiatric symptoms in fronto-parietal control and attention networks. Specifically, deteriorated mental health—characterised by higher levels of anxiety, depression, stress, and fatigue, as well as reduced well-being and quality of life—are associated with stronger stomach-brain connections. Crucially, we controlled for brain connectivity, neural variability, bodily mass, and gastric function, thus this link is specific to the stomach-brain axis. We discovered a unique stomach-brain fingerprint of mental health, highlighting a previously unknown visceral component of psychiatric illness. Understanding the role of disrupted gut-brain mechanisms in mental health can potentially refine diagnostic strategies and lead to new therapeutic interventions seeking to remediate maladaptive connections between the body and mind.

Location: Cafeteria
Poster 93

Affective Touch Experience in Pre-Term Adults Deprived of Early Touch: a mixed-method study

Emily Jackson, David Moore, Valentina Cazzato

Individuals born preterm are typically treated in the Neonatal Intensive Care Unit (NICU), kept in incubators, and separated from early physical contact when they would otherwise be receiving constant caress-like stimulation of lanugo hairs via circulation of amniotic fluid in their mother's womb. Babies treated in the NICU miss out on early nurturing touch during critical stages of social brain development. Early touch experiences epigenetically shape the developing social brain, establishing neural networks underpinning social behaviour across the lifespan, and individuals deprived of early touch have been found to have abnormal responses to sensory inputs and impaired social relationships throughout the life. Recent studies show that tactile hypersensitivity is also common in premature individuals, along with adverse responses to intimate touch in adulthood. Yet, we do not know how premature individuals experience touch in their daily lives. Using a mixed methods approach, we aim at characterising affective touch responses in relation to individual differences in attachment style, experiences of/attitudes towards intimate touch in adulthood, as well as eating disorders traits, in individuals born preterm. A semi-structured interview will be conducted to explore how premature individuals (born before 37 weeks of pregnancy) describe their experiences of touch within close relationships across the lifespan. A cross-sectional online study will also test the relationship between touch deprivation and topography and relationship-specific hedonic evaluation of affective touch. We expect premature individuals to experience interpersonal touch as adverse and for this to impact their close relationships, with social avoidance and isolation presenting as core themes.

Location: Cafeteria
Poster 94

Unveiling the dynamics of social touch in autistic and non-autistic adults during intimate, friendly, and professional interactions

Martina Fusaro, Manuel Mello, Salvatore Maria Aglioti, Ilaria Minio-Paluello

Within the study of social touch, the dynamics involving factors like sex attributed at birth, body area, and social context have received considerable attention in typically developing populations. Less emphasis has been placed on understanding these aspects in autism. To fill this gap, we investigated social touch experiences in 128 adults (50% autistic, 50% women in each group). The study was conducted online: participants received descriptions of intimate, friendly, or professional contexts tailored to their gender identity and sexual orientation. They provided ratings on three social dimensions—erogeneity, appropriateness, and pleasantness—by colouring silhouettes of their bodies. Our findings reveal distinct patterns in social touch experiences between autistic and non-autistic adults. Autistic individuals, compared to their non-autistic counterparts, consistently reported lower levels of pleasantness, erogeneity, and appropriateness, particularly within intimate and friendly contexts in body areas typically associated with such interactions. Sex was a significant factor in these group differences. For instance, autistic females, regardless of context, reported lower pleasantness than non-autistic females and autistic males. In the professional context, typically associated with appropriate touch, autistic females reported similar levels of appropriateness to non-autistic females and autistic males. It is important to mention that this study was conducted as participatory research, with autistic consultants involved in interpreting the findings, highlighting limitations and reviewing the manuscript. Our results bring insights into social touch experiences of autistic and non-autistic adults, suggesting potential differences in perception and conceptualization. Identifying influencing factors could guide the development of targeted support to enhance touch-related well-being for autistic individuals.

Location: Cafeteria

Poster 95

The serial role of parental burnout and emotion regulation on depressive symptoms among mothers of children with developmental disabilities

Mor Keleynikov, Noga Cohen, Joy Benatov

Raising children with developmental disabilities (DD) may be associated with parental depression. To shed light on the underlying mechanisms of this link, we introduced the Strained Parenting and Emotion Regulation model, which proposes that the demanding nature of caregiving can cause burnout, depleting resources crucial for effective emotion regulation (ER). This reduction in the use of adaptive ER strategies, in turn, makes this population susceptible to burnout, which only reinforces this vicious cycle. Based on this model, we explored whether the link between parenting a child with DD and maternal depression is mediated by burnout and two ER strategies: cognitive reappraisal and acceptance. Therefore, 135 mothers answered questionnaires measuring parental burnout, ER tendencies, and depression levels. The findings confirmed our predictions, showing that mothers of children with DD experience higher burnout, which predicted a lower tendency to use reappraisal and acceptance, subsequently leading to higher depression levels. These findings highlight a paradox: mothers of children with DD could gain an advantage from employing adaptive ER strategies, given their elevated levels of parental burnout and depressive symptoms. However, the cognitive processes required for ER might be compromised in mothers undergoing parental burnout. Together, these findings suggest that among mothers of children with DD, parental burnout may drain the cognitive resources needed for the implementation of adaptive ER strategies, which may eventually lead to depression. Therefore, enhancing ER alone in this population may not be sufficient to reduce psychological distress, as ER may be compromised due to resource depletion resulting from burnout.

Location: Cafeteria
Poster 96

Objectively quantifying micro self- and co-regulation dynamics in a cohort of dysregulated infants and families enrolled in an intervention program.

Ward Deferm, Binu Singh, Sara De Bruyn, Edwin Wouters, Sam Wass, Bea Van den Bergh, Maarten de Vos, Bart Boets

Early interactions between infants and caregivers significantly influence brain development and social bonding. Biobehavioral synchrony, involving behavioral, hormonal, autonomic nervous system (ANS), and neural synchrony, is proposed as a fundamental mechanism in parent-infant co-regulation. However, a micro mechanistic understanding, especially regarding the impact of parental stress on synchrony, is lacking.

This study aims to objectively quantify self- and co-regulation dynamics in infants with regulation problems and their parents, using state-of-the-art dual measurements. The study will follow participants through a clinically successful intensive family-based intervention program, with a focus on reducing parental stress. The research investigates directional associations between parental stress, biobehavioral synchrony, and parental and infant self-regulation, addressing gaps in current research.

Dual measurements, including EEG for neural activity, behavioral assessments (eye gaze, facial mimicry, vocalizations), and stress physiology measures (heart rate and skin conductance), will be employed during dyadic interactions. Beyond the lab, day-long ANS and vocalization recordings in home settings, along with diary measures, provide a holistic perspective. Multiple time-points will be assessed to investigate postulated directional associations among parental stress, self-regulation, and co-regulation.

This study aims to advance our understanding of biobehavioral synchrony in parent-infant relationships, particularly in dysregulated populations. The innovative methodology, encompassing diverse measurements in both controlled and naturalistic settings, offers a unique opportunity to uncover nuanced patterns of synchrony. The findings may inform interventions targeting parent-child relationships, emphasizing the importance of considering both mothers and fathers. The presentation will outline the study design and share initial dyadic data.

Location: Cafeteria
Poster 97

I knew you should not be trusted! Age-related differences in trust dynamics and adaptive behavior in social learning across adolescence

Selin Topel, Bianca Westhoff, Lucas Molleman, Essi Viding, Eveline Crone, Ellen de Bruijn, Henk van Steenbergen, Wouter van den Bos, Anna van Duijvenvoorde

Successful social behavior and the ability to establish lasting relationships rely on the capacity to adapt and learn from social cues. This involves learning to withhold trust from unreliable individuals and extend it to those who reciprocate trust. Adolescence marks a phase of social reorientation, during which the social cognitive abilities of individuals including social reward responsiveness and learning from feedback undergo significant changes. In our study, we investigated age-related differences in social learning, including behavioral and fMRI data from 152 adolescents between ages 10-24 using a trust game where participants responded to either mostly trustworthy or untrustworthy groups of individuals. Learning to trust the trustworthy group improved across trials for all ages, while withholding trust from untrustworthy group improved across trials only in older adolescence. Largest differences in learning about the trustworthy and untrustworthy groups across trials was in mid-adolescence. Using computational models we examined valenced learning, social preferences, and counterfactual learning strategies. We found age-related differences in the effects of valence and counterfactual learning. Notably, older adolescents were quicker to decrease the subjective value of trusting unreciprocating individuals, even when the outcome did not directly impact their payout. Furthermore, we will combine the behavioral computational patterns with adolescents' neural responses to investigate the interplay between reward-based learning and social cognitive brain networks and its role in the age-related differences in trust-learning. This approach enhances our understanding of trust dynamics and social learning computations, and also sheds light on the neural processes shaping socially adaptive behavior across adolescent development.

Location: Cafeteria
Poster 98

Childhood maltreatment affects physiological synchrony within caregiver-adolescent dyads

Angelika J. Bracher, Jan Keil, Dorukhan Acil, Georg von Polier, Lars O. White

Caregiver-child relationships are crucial for developing children's emotion regulation capacities and subsequent psychosocial functioning. However, experiencing childhood maltreatment, including abuse and neglect, increases the risk of psychopathology. Dyadic synchrony has been proposed as a key mechanism impacting that development, and previous studies have shown that parent-child dyads with maltreatment experience display distinct patterns of cardiac co-regulation during stress (Lunkenheimer et al., 2018). Yet, little is known about how cardiac synchrony functions during adolescence. To fill this research gap, we will investigate cardiac synchrony during an adapted Trust Game (TG; Keil et al., in preparation) in adolescent-caregiver dyads with and without experiences of childhood maltreatment. The study will include ~150 dyads from a large-scale longitudinal study in Germany. We will assess maltreatment subtypes, chronicity, and severity through the Maltreatment Classification Interview and System (Barnett, Manly & Cicchetti, 1993). During the TG participants alternately interact with their respective caregivers and ostensibly with an unfamiliar peer, who is actually computer-generated and programmed to act uncooperatively so as to induce distress. Cardiac synchrony will be calculated using Local Power (Bornemann et al., 2016), a short-term estimate of high-frequency Heart Rate Variability (hf-HRV) that allows for investigation of hf-HRV shifts within seconds. We expect to find cardiac synchrony differences between our maltreated and control groups, particularly during the stress conditions of the TG. Furthermore, we hypothesize to find unique cardiac synchrony signatures within dyads where children have been neglected versus abused.

Location: Cafeteria
Poster 99

Structural cortico-subcortical connectivity and its relation to social self-regulation across development

Ann Hogenhuis, Loes Keijsers, Michelle Achterberg

Growing up, children encounter various social challenges, including social rejection. While some may experience ongoing mental health issues like depression or aggression as a result, others seem to handle social rejection without much harm to their well-being. Previous studies have shown that late childhood could be a sensitive period for the regulation of aggression following social rejection. Not only has variability in social self-regulation been associated with individual differences in neural activation in the dorsolateral prefrontal cortex (PFC), variations in the development of structural connections between the PFC and ventral striatum have been linked to individual differences in self-regulation as well. The current preregistered study will therefore examine the fractional anisotropy (FA) in the cortico-subcortical pathways to find out whether changes are related to variations in social self-regulation. Using random-intercept crossed lagged panel models (RI-CLPM) in a large (N>500) 4-wave longitudinal design, it will be investigated whether there are specific periods in 7-to-14-year-olds in which changes in structural connectivity can predict social self-regulation or vice versa. The data collection has finished on October 1st and we are currently running data analyses. During the ESCAN conference we can present the preliminary results.

Location: Cafeteria
Poster 100

Studying observation of other's movements in children with a motor disorder

Griet Warlop, Silvia Formica, Emiel Cracco, Jan R. Wiersema, Frederik J.A. Deconinck

Developmental Coordination Disorder (DCD) is a neurodevelopmental disorder affecting the execution and acquisition of motor skills, to the extent that it significantly impacts daily functioning. One hypothesis explaining the deficiencies in DCD is related to impaired internal models of action, which would affect accurate prediction of movements. To elaborate on this hypothesis and in accordance with ideomotor theory, that posits shared representational codes between action execution and perception, we investigated whether the disruptions in action planning and execution in this population also extend to action perception in two studies. First, we examined and compared biological motion perception in children with (N = 33; age: 13.0 ± 2.0) and without DCD (N = 33; age: 13.0 ± 1.9) using EEG frequency tagging. While the DCD group showed similar perception of fluent biological motion from sequences of static body postures, differences surfaced in the perception of repeating stimuli, suggesting altered predictive processing in the perceptual domain. In a subsequent experiment, we examined automatic imitation, to determine if observation of an action triggers an internal motor representation. Although children with DCD demonstrated a similar automatic imitation effect based on their reaction times, event-related potentials recorded by EEG indicated a delayed N190, related to the visual processing of body parts. Additionally, a slightly lower P300, sensitive to self-versus-other processes, was observed in the DCD group. In summary, our study suggests intact behavioral markers, but differences in neurophysiological markers indicate disturbances in action perception in DCD.

Location: Cafeteria
Poster 101

Developmental trajectories of trust and their underlying neural correlates in adolescents of different SES

Ethell-Marjorie Dubois

Adolescence is a period during which social relationships become increasingly important. Trust plays an important role in the successful development and maintenance of these relationships. During adolescence, sociocognitive processes underlying trust such as social learning processes and perspective-taking develop. Trust has consistently been correlated with individuals' socioeconomic status (SES), with high SES individuals reporting higher trust. However, the influence of SES on adolescents' trust and the functioning of the underlying neural mechanisms remain unknown. Hence, we aim to examine whether adolescents' trust varies between different targets of society, how their trust develops, and how adolescents' trust is influenced by their SES, age, and gender. We will employ the modified economic fMRI Trust Game to determine adolescents' trust behavior towards different targets including close (i.e. friends), societal (i.e. authoritative/institutional), and distant others (i.e. unknown peers) in 600 adolescents aged 10 to 20. We expect a positive correlation between adolescents' level of trust and the distance of the target. We also anticipate an age-dependent increase in trust and gender-differences with adolescent males reporting higher trust than adolescent females. Additionally, we hypothesize that the target differentiation will be more pronounced for low SES adolescents. Lastly, we expect neural activity in social brain regions, including the precuneus and temporal parietal junction, to reflect this target differentiation. As part of the GUTS consortium, this research aims to contribute to determining how adolescents grow up in an increasingly complex society.

Location: Cafeteria
Poster 102

Using EEG measures to assess the development of self-regulation and mental health outcomes across adolescence

Yvette Grootjans, Anita Harrewijn, Ingmar Franken

Young people encounter many societal challenges while growing up. The Growing Up Together in Society (GUTS) project is a longitudinal study of seven universities in the Netherlands spanning over 10 years. The GUTS project will investigate how neurobiological and social-cognitive factors interact with social and societal opportunities in becoming a contributing member of society. The present study design, as part of the GUTS project, will investigate why some adolescents develop mental health problems while others do not. Electrophysiological activity will be recorded while participants perform the social flanker task, a go/no-go task, and a vicarious reward task, all measuring processes related to self-regulation, such as error processing, inhibition, and reward processing. The error-related negativity (ERN) has been associated with error processing and inhibition and appears to change in magnitude across development. The ERN has shown to be increased in internalizing disorders (e.g. anxiety disorders) and decreased in externalizing disorders (e.g. substance use disorder). Therefore, the ERN might be a useful marker of risk to predict longitudinal increases in several mental health problems. The goal of this poster is to receive feedback on the current study design and inspire collaborations.

Location: Cafeteria
Poster 103

Repeatability of electrophysiological responses to pluri-sensory stimulations in young children.

Marianne Latinus, Mathilde Sassier--Roubin, Lisa Michel

Neurodevelopment is dynamic process that involves different sensitive period, and which differs from one child to another in particular in children with neurodevelopmental disorders. To allow for longitudinal study during development it is important to assess whether the protocol used provides data that are repeatable. The current study aims to validate the repeatability of event-related potentials (ERPs) in young children through a pluri-sensory stimulation protocol. The main hypothesis argues that for each child, there is a strong correlation between the responses obtained at two separate sessions conducted one week apart. Twenty children aged 2 years 6 months to 5 years 4 months (mean age: 3 years 10 months $\pm$ 10 months), with neurotypical development, participated in this study. ERPs evoked by visual, auditory, and tactile stimulation varying in complexity, including simple, complex, and social stimuli, were recorded; ERPs components were characterized by their latency, amplitude, and intra-individual variability through the Median Absolute Deviation (MAD) and Inter-Trial Consistency (ITC). The Pearson's correlation of the parameters obtained at the two sessions was calculated for each child. The results demonstrate good individual-level repeatability for amplitude and latency; however, measure of repeatability based on intraclass correlation coefficients suggested weaker repeatability. Therefore, the individual-level results confirm the similarity of electrophysiological responses obtained one week apart, even in very young children and the relevance of the established experimental paradigm for the target population. Yet, the results question the relevance of using intraclass correlation coefficient in population with a relatively high behavioural instability.

Location: Cafeteria
Poster 104

Delay discounting in adolescence depends on who you wait for: Evidence from a functional neuroimaging study

Lotte van Rijn

Adolescents are increasingly able to give up an immediate smaller reward for a larger delayed reward, thereby showing reduced delay discounting. Adolescence is also a time of social reorientation, where decisions not only weigh immediate against future outcomes, but also consequences for self against others. In this fMRI study, we examined the neural correlates of immediate and delayed reward choices where delayed outcomes could benefit self, friends or unknown others. In total, 196 adolescent twins between 13-16 years completed a social delay discounting task and in 174 of these participants fMRI data were acquired. In total, 156 adolescents had valid fMRI data and 138 adolescents had observations in every condition. Adolescents more often chose the immediate reward when it was larger, and when the delay was longer. Area-under-the-curve (AUC) comparisons revealed that behavior differed for delay-beneficiaries, such that AUC was highest for the self, followed by friend and then unknown other, suggesting that adolescents are more willing to wait for rewards for self. Neuroimaging analyses showed that the midline areas medial prefrontal cortex (MPFC) and precuneus, as well as bilateral temporal parietal junction (TPJ) were more active when considering delayed reward for unknown others and friends relative to self. A whole-brain interaction with choice showed that the bilateral insula and right dorsolateral prefrontal cortex (DLPFC) were more active for delayed choices for unknown others and for immediate choices for friends and self, underlining that the neuro-cognitive processing of how delays reduce the value of rewards depends on the beneficiary closeness.

*Location: Cafeteria
Poster 105*

Development of empathy from adolescence to adulthood

Francisco Esteves, Augusta Gaspar

The aim of the study was to follow the development of empathy from early adolescence to adulthood, comparing five age groups (from pre-adolescents to adults). Furthermore, empathy assessment was done toward two different targets—humans and animals. Four-hundred sixty-eight adolescents (aged 11-18), and 149 adults answered the Portuguese validated scales regarding empathy towards humans - the Interpersonal Reactivity Index (IRI), and the Animal Empathy Scale (AES). The sample was divided in five age groups (11-12; 13-14; 15-16; 17-18; and adults (19-55), being 57% females and 43% males. The four subscales of IRI (empathic concern, perspective taking, personal distress and perspective taking) were also analyzed. The results showed that empathy toward animals and most dimensions of empathy toward humans increase toward adulthood, with interesting gender differences. In general girls showed higher empathy values than boys (in both scales, although with a larger differentiation in the IRI results), and with empathy levels in girls starting off in the age trajectory at higher levels. A moderate correlation between empathy toward human and toward animal targets was also found. These results contribute to the knowledge of the developmental “pace” and trajectory of the various dimensions of empathy, and the relationship between empathy towards humans and towards other animals.

Location: Cafeteria
Poster 106

Neural Underpinnings of Mindfulness-Based Stress Reduction in University Students with Stress-related Complaints

Nikos Kogias

University students, often juggling academic responsibilities and personal challenges, are particularly susceptible to stress. Mindfulness, defined as present-moment non-judgmental awareness, has been shown to be an effective approach in reducing stress-related symptoms. However, the mechanisms through which mindfulness affects stress regulation are not well understood. To bridge this gap, we investigated the neural mechanisms of Mindfulness-Based Stress Reduction (MBSR) in university students. A randomised controlled trial was conducted on a sample of 60 university students experiencing high levels of perceived stress. In addition to assessing clinical effects, we used functional MRI to evaluate the neural basis of MBSR. Participants were engaged in stress regulation tasks, such as an emotional conflict resolution task and a resting state MRI scan following a robust stress induction paradigm. Our preliminary findings suggest an association between enhanced activity in the Posterior Parietal Cortex and higher mindfulness skills in our baseline data – i.e., data collected prior to the MBSR intervention – during emotional conflict resolution. This association hints at the possibility that mindfulness might lead to adapted neural strategies for stress regulation. Analysis of the post-intervention data is ongoing and will be the focus of this presentation. We anticipate that these findings may provide valuable insights into the mechanisms through which MBSR exerts its stress-reducing effects. This could potentially pave the way for the development of more effective stress management strategies for university students, contributing to their overall well-being.

*Location: Cafeteria
Poster 107*

Increase attentional fatigability with a chronic sleep debt: biological stress markers and nap recovery strategy.

Arnaud Rabat, Lili Mouton, Laura Poudevigne, Louise Gaillard, Mounir Chennaoui, Aurélie Servonnet, Damien Léger, Brice Faraut

Rationale of this study:

This study explores the combined effect of a mild chronic sleep debt (-2 hours by night / 5 nights by week / 5 weeks) with a prolonged cognitive engagement. We hypothesize that fatigability of sustained attention will be increased with a mild chronic sleep debt that challenge the capacity of the biological stress response to face a prolonged cognitive engagement. Potential benefit of a daily recovery nap has been as well investigated.

Methodological procedures and main results:

16 participants were placed in three experimental groups according to their ecological sleep condition: control, sleep debt, and sleep debt + daily nap. Sleep was monitored at home for 5-7 weeks (actigraphy, sleep monitoring with OURA ring). Participants underwent prolonged cognitive testing (30 min./test) and salivary sampling on four experimental days at the beginning (1st week) and at the end (5th week) of this protocol. Our results show that sustained attention fatigue was more pronounced in participants with chronic sleep debt, and less pronounced in the control and the nap group. We also observed a blunted circadian profile of cortisol and alpha-amylase in the chronic debt group, and a restoration of the cortisol and the alpha-amylase profiles in the group with sleep debt and nap.

Main conclusions:

A natural and mild chronic sleep debt (-2h/night, 5 nights/week) increases attentional fatigability during a prolonged PVT (30 min). We observed a blunted circadian profile of stress markers in chronic sleep debt, whereas a recovery nap would attenuate the deleterious effects observed.



May 25th – 3:00pm – 3:30pm

ORAL TALKS

Saturday, May 25th 2024 // 3:00pm - 4:30pm

Location: Auditorium 2

Oral talks 15: Social Support & Stress

Let Me In: The Neural Basis of Inclusion Motivation in Loneliness

Alisa Kanterman

While it is well-established that humans possess an innate need for social belonging, the neural mechanisms underlying motivation for connection are still largely unknown. We propose that inclusion motivation – measured through the effort that individuals are willing to invest to be included in social interactions – may serve as one of the basic building blocks of social behavior and may change in lonely individuals. Following the screening of 303 participants, we scanned 30 low- and 28 high-loneliness individuals with functional magnetic resonance imaging while they performed the Active Inclusion Task (AIT). The AIT assesses the participants' levels of effort invested in influencing their inclusion during classic Cyberball conditions of fair play and exclusion. High- compared to low-loneliness individuals showed higher urgency for inclusion, specifically during fair play, which correlated with higher activity in the right thalamus. Furthermore, in high-loneliness individuals, we found increased functional connectivity between the thalamus and the temporoparietal junction, putamen, and insula. We conclude that inclusion motivation in loneliness is heightened during fair but not exclusionary interactions, and is linked to activity in brain regions implicated in appetitive behavior and social cognition. The findings indicate that lonely individuals may view threat in inclusionary interactions, prompting them to take action to regain connection. This suggests that inclusion motivation may help explain social difficulties in loneliness and possibly in other conditions, including psychiatric disorders.

Location: Auditorium 2

Oral talks 15: Social Support & Stress

The effect of anhedonia on approach-avoidance social decisions in depression

Rocco Mennella, Nathan Risch, Emilie Olie, Julie Grèzes

Major Depressive Disorder is characterized by the presence of persistent negative mood and/or anhedonia. Anhedonia has been related to deficits in motivated behaviour, i.e., behaviour oriented toward desirable and pleasurable outcomes. Accordingly, depressed individuals show altered valuation of emotional stimuli and impairments in decision making, notably in situations where an active effort is demanded. Nonetheless, it remains unclear whether spontaneous approach-avoidance decisions in socio-emotional contexts are altered in depression. Here depressed patients with ($n = 24$) and without previous suicide attempts ($n = 24$) and healthy controls ($n = 23$; all groups age- and gender-matched) completed a social decision-making task. Participants freely chose where to sit in a waiting room with individuals displaying happy or angry expressions. In some trials after the first response, participants had to make a supplementary effort (switch button press) to sit where they initially wanted. Our results showed that depressed participants were less willing to sit close to (approach) happy individuals in the first place, as well as to produce an additional effort to obtain desirable outcomes, i.e., to approach happy and avoid angry individuals, compared to controls. Importantly, both results strongly correlated with anhedonia severity. Our results open new perspectives in the debate between theories of depression and motivation to emotional stimuli. We propose that in situations where little or no effort is demanded, blunted motivation might be specific to positive/affiliative signals. On the other hand, blunted responsiveness to both positive and negative emotional might reveal in situations that require an active effort.

Predicting resilience from psychological and physiological daily-life measures

Florian Krause

Monitoring mental well-being with mobile and wearable devices has become an important component in the development of preventive interventions for stress-related psychopathology. We investigated the potential of daily-life psychological and physiological measures from Ecological Momentary Assessments (EMA) using mobile phones and Ecological Physiological Assessments (EPA) using wearable wristbands, as well as their combination, for predicting long-term stress resilience on data from a large-scale longitudinal observational study within the international “DynaMORE” project (<https://dynamore-project.eu>). We operationalized resilience through normative modelling as inverse stressor reactivity (SR) at multiple measurement time points across a six-month period. This allowed us to explicitly separate the contributions from between-subject and within-subject variances in EMA and EPA measures to interindividual differences in SR and intraindividual fluctuations in SR over time. We used linear mixed models to understand how those variances in each EMA and EPA measure are associated with SR, and trained machine learning models (random forest regression) to predict either a participant’s average SR score (capturing only interindividual differences) or each of a participant’s multiple measured SR scores separately (capturing also intraindividual fluctuations) from EMA, EPA or combined EMA+EPA data. We identified significant associations between changes in SR and various psychological and physiological measures – both between-subject and within-subject. We furthermore successfully demonstrate that SR scores can be predicted with moderate accuracy using machine learning models, and that these models perform best when considering intraindividual fluctuations in SR scores. I will discuss implications for future research on daily-life measures of stress resilience and its clinical applications.

Location: Auditorium 2

Oral talks 15: Social Support & Stress

How academic stress relates to effortful prosocial behaviour and students' academic achievement

Lonneke Elzinga, Giulia Murgia, Todd Vogel, Jo Cutler, Matthew Apps, Merel Tejjink, Oliver Genschow, Berna Güroğlu, Nienke van Atteveldt, Eveline Crone, Patricia Lockwood, Anna van Duijvenvoorde

Recent research incorporates the role of effort in prosocial behaviour, little is known about how prosocial behaviour relates to academic achievement and the moderating role of academic stress. This preregistered study therefore investigated how academic stress affected effortful actions for oneself and others (<https://osf.io/bne5u/>). During an online prosocial effort task, 510 students (18-35 years) chose between resting for lower rewards or exerting effort for higher rewards (Contreras-Huerta et al., 2022; Lockwood et al., 2017). Reward and effort varied over trials. Rewards could be obtained for oneself or an unknown other. During wave 1, half the sample completed the task in an exam period, the others during regular academic weeks. At wave 2, there were no exams. Preliminary analyses of wave 1 indicated that participants exerted more effort for self than others, and effort allocation was sensitive to reward and effort levels. Individuals who exerted more effort for others did not show higher academic performance. Interestingly, greater academic stress was associated with increased effort exertion for others. Currently, we are comparing longitudinal and computational models on within-subject effects in prosocial effort allocation. Our findings could help elucidate when people act prosocially and how it can benefit students' wellbeing and academic success. A next step is to examine prosocial effort allocation from a developmental perspective within the large-scale GUTS consortium in adolescents aged 10-20 years old from diverse socioeconomic backgrounds (<https://www.gutsproject.com/>).

Location: Auditorium 2

Oral talks 15: Social Support & Stress

Stress relief through social support does not depend on endogenous opioid signalling

Guro Løseth, Molly Carlyle, Vera Rudi, Marie Eikemo, Siri Leknes

INTRODUCTION: The assumption that social support provides stress relief and induces positive emotions through endogenous opioids has been with us since Panksepp proposed the Brain Opioid Theory of Social Attachment (BOTSA) 46 years ago.

METHODS: We tested this assumption in a pre-registered (osf.io/5k2wj) between-subject double-blind randomized placebo-controlled study. 129 pairs of real-life friends (65 female dyads, 258 participants total) received 50mg per-oral naltrexone (opioid antagonist) or placebo and spent 1 hour in social isolation before a dyadic social stress task. Afterwards, participants either interacted freely with their friend (social support condition) or were kept apart (non-support condition) during a 5-min recovery period. Then, participants were separately re-exposed to social evaluative threat through video clips displaying evaluation criteria for, and excerpts of, their own stress-task performance.

RESULTS: Overall, stress exposure significantly increased mean ratings of (VAS 0-100) negative mood (+26, SE=1.4) and stress (+23, SE=1.2), and reduced positive mood (-22, SE=1.2) from baseline. Compared to non-support (NS), social support (SS) improved recovery of positive mood (SS-NS=12.2, SE=2.4, $t(119)=5.1$, $p<.001$), negative mood (SS-NS=-5.8, SE=2.7, $t(119)=2.1$, $p=.035$) and stress (SS-NS=-5.2, SE=2.5, $t(119)=2.2$, $p=.029$), with no significant difference between drug conditions (all $p>.47$). Video clips increased ratings (VAS 0-100) of embarrassment across support conditions (mean change from post-recovery: NS= +17, SE=1.7; SS= +25, SE=2.4). However, embarrassed ratings were generally lower in the social support condition (SS-NS= -8.05, SE=2.9, $t(247)=-2.8$, $p=.006$), with no significant difference between drug groups (SSplacebo - SSnaltrexone= 1.3, SE=4, $t(144)=0.3$, $p=1$).

CONCLUSIONS: Social support does not depend on intact endogenous opioid signalling to boost stress recovery.

Location: Auditorium 4

Oral talks 16: Motor processing

Evidence for motor simulation during inner speaking

Ladislav Nalborczyk, Marieke Longcamp, Mireille Bonnard, Victor Serveau, Laure Spieser, François-Xavier Alario

The mental production of speech or “inner speech” is a foundational ability in humans, involved in a plethora of activities, such as reading, writing, planning, or remembering. Inner speech is generally accompanied by a subjective multisensory experience featuring most notably auditory percepts (the “inner voice”). The cognitive and neural mechanisms leading to these percepts are still debated. Moreover, inner speech has at least two distinct phenomenological components: inner speaking and inner hearing. In this study, we used transcranial magnetic stimulation to test whether inner speaking and inner hearing are supported by distinct neural mechanisms. We hypothesised that inner speaking relies on a motor-to-sensory mental simulation that constructs a multisensory experience, whereas inner hearing relies on a memory-retrieval process whereby the multisensory experience is retrieved from stored motor-to-sensory associations. Accordingly, we predicted that the speech motor system should be involved more strongly during inner speaking than inner hearing. This would be revealed by modulations of TMS evoked responses at the muscle level following stimulation of the lip primary motor cortex. Data collected from 31 participants corroborated most of these predictions, suggesting that inner speaking increases the excitability of the primary motor cortex more than inner hearing. This increase in cortical excitability was more pronounced during the inner production of a syllable that strongly recruits the lips (vs. a syllable that does not). These results are compatible with models assuming a central role of the primary motor cortex for inner speech production and contribute to clarifying the neural implementation of inner speech.

Location: Auditorium 4

Oral talks 16: Motor processing

The acute effect of motor imagery combined with action observation on brain electrical activity and cardioventilatory responses in sedentary individuals

Ebrar Atak, Amine Ataç

Objective: This study's objective was to investigate the acute effect of motor imagery (MI) exercise combined with action observation (AO) in the form of breathing exercise on brain electrical activity and cardioventilator responses.

Methods: A total 33 individuals were included in motor imagery+action observation group (MI+AOG_r), active breathing exercise group (AREGr), and control group (CGr). Electroencephalography (EEG) data were recorded for 10 min with the Muse EEG headband. Before and after the interventions, the number of ventilations, pulse, saturation and blood pressure were measured. Cognitive abilities were assessed with the Montreal Cognitive Assessment (MOCA), imagery abilities with the Kinesthetic and Visual Imagery Questionnaire (KVIQ) and mental stopwatch (including the Time Up and Go (TUG) test).

Results: In the evaluations between the groups there was a significant difference in the TUG test in the last measurements ($p < 0.05$). There were significant changes in systolic blood pressure in MI+AOG_r and in KVIQ kinesthetic score in AREGr ($p < 0.05$). There were significant changes in MOCA and TUG scores for MI+AOG_r and AREGr ($p < 0.05$). For EEG data, there were decreases in delta and theta power at the TP location during the application in MI+AOG_r compared to before ($p < 0.05$).

Conclusion: MI+AO method may be methods that can provide improvement in SBP, TUG test and cognitive functions and related EEG data. In cases where there are restrictions or unsuitable conditions for physical exercise, mental exercise methods may cause acute changes in the development of cardiac parameters and physical and cognitive characteristics in healthy individuals.

Location: Auditorium 4

Oral talks 16: Motor processing

Beta Burst Rate and Waveform Motifs Change According to Different Motor Learning Tasks.

Quentin Moreau, Maciej Szul, James Bonaiuto

Beta oscillations (14-30 Hz) over the motor cortex are known to be modulated during movements, with a decrease in power prior to and during actions, followed by a rapid increase after their completion. Recent findings challenge the traditional view of sustained beta rhythms, revealing that beta activity comprises short-lasting bursts rather than continuous oscillations. In the current study, 38 participants underwent a high-precision MEG protocol during a visuomotor adaptation task. The task involved observation of a rotational random dot kinematogram (RDK) with varying coherence levels, followed by a joystick-based reaching movement to direct a cursor towards a target, with the cursor's visual location subject to a rotational visuomotor perturbation. One group of participants, the explicit group, experienced clockwise or counter-clockwise perturbations but could predict the direction of the perturbation in each trial from the direction of coherent motion in the RDK and redirect their aim to account for it. In contrast, the implicit group adapted to a constant rotation unrelated to motion coherence. Employing an innovative burst-detection algorithm and waveform analysis, we found that beta bursts with different waveform shapes were differentially rate-modulated based on task demands. This variability suggests that different types of beta bursts reflect different mechanisms associated with cognitive and motor processes. Hence, we suggest that beta burst waveform shapes provide a window into neurodynamics underlying distinct computational processes. In essence, this research provides insights into the complex role of beta activity in cognitive and motor processes, suggesting that beta burst diversity represents diversity in function.

Location: Auditorium 4

Oral talks 16: Motor processing

Rethinking motor variability: a model for unpacking the components that influence variations in motor outcomes

Camilla Maronati, Luca Casartelli, Andrea Cavallo

In the last years, the source and the functional meaning of motor variability have attracted considerable attention in behavioral and brain sciences. One of the sources of debate is whether variability is beneficial or detrimental. We believe that this is an ill-posed problem that originates from an ill-defined construct, since terms like “variability”, “variation”, “fluctuations”, or “noise” are often used inconsistently across research fields. In the present talk, exploiting a comprehensive review of the literature, we build a lexicon that goes beyond the generic use of motor variability. We propose three motor variability domains related to computational components that influence changes in motor outputs. The first two are “noise” and “differentiation”: “noise” concerns all stochastic or probabilistic fluctuations in motor output; “differentiation” reflects our open-ended, multiple-choice motor vocabulary. However, the key contribution of the model is the domain of “adaptability”, which refers to variation within the same motor representation. In this domain, we denote the portions of motor variability that depend on our propensity to learn (i.e., “learning”) and on our tendency to be influenced by external factors (i.e., “(social)fitting”). Furthermore, a particular focus is made on “co-adaptability”. This sub-domain concerns the ability to adapt movement patterns to promote inter-individual tuning. Further theoretical, experimental and clinical challenges arise from such a rethinking of motor variability and are discussed in our model. All in all, our theoretical work suggests that motor variability is neither simply detrimental nor beneficial, and that investigating its fluctuations can have a meaningful impact on future research.

Location: Auditorium 4

Oral talks 16: Motor processing

Anticipating danger: fearful expectations revealed in prospective motor control

Riccardo Villa, Nathan C. Foster, Eugenio Scaliti, Mariacarla Memeo, Nicola M. Engel, Kiri Pullar, Stefano Panzeri, Jan Haaker, Cristina Becchio

Motor control anticipates future states. Here we took advantage of fear conditioning to investigate how anticipation of threat is prospectively encoded in movement kinematics. Using a near-infrared motion capture system, we tracked naive participants reaching towards, grasping, and transporting one of two cubes (a blue or yellow cube). During the acquisition phase, contact with one cube (conditioned stimulus, CS+; counterbalanced across participants) was predictive of electrodermal stimulation in 30% of trials. Participants learned to fear contact with CS+ cube as indexed by larger skin conductance responses (SCRs) to CS+ trials than to CS- (control cube) trials. Kinematic analysis revealed an unexpected subtyping of participants into two phenotypes: an 'approach phenotype', characterized by faster responses and movements to CS+ than to CS- trials, and an 'avoid phenotype', marked by slower responses and movements towards CS+ relative to CS-. These findings highlight the potential of detailed measures of naturalistic behavior to reveal novel insights into how individuals anticipate danger.

Location: Auditorium 1
Oral talks 17: Emotion II

The modulation of pupil size and facial mimicry in response to social stimuli requires conscious awareness

Cecilia Dapor, Irene Sperandio, Federica Meconi, Daniela Ruzzante

Continuous flash suppression (CFS) has been widely used to investigate the effects of semantic or emotional processing on visual perception. We used a variant of the CFS paradigm (break-through CFS), not only to confirm a top-down modulation of visual awareness driven by social contents, but also to examine if implicit processing of emotional content precedes or follows its conscious appraisal. To this aim, we have chosen pupil dilation and facial mimicry as implicit responses to emotional social stimuli and collected these measures during the bCFS task. Stimuli consisted of emotional facial expressions (happy, fearful, neutral) and their phase-scrambled versions. All stimuli were matched in terms of luminance. To the right eye, we presented a stream of Mondrian patterns, which temporarily suppressed the visual stimuli presented to the left eye. We recorded reaction times for the stimulus to break through suppression.

Behavioural findings showed that participants became aware of the face images faster than their scrambled versions. Furthermore, happy faces were detected faster and more accurately than fearful or neutral faces. On the physiological side, results from pupillometry and electromyography revealed that top-down modulation of the pupil and facial reactions occurs only after the conscious perception of the stimuli. These findings suggest that non-threatening emotional social stimuli (faces) elicit specific physiological responses only after their conscious appraisal. This paradigm can potentially contribute to our understanding of the multiple pathways that a social stimulus follows from its early visual recognition to its cognitive interpretation, through its resonance in the autonomic nervous system.

Location: Auditorium 1
Oral talks 17: Emotion II

Keeping a Straight Face: EMG investigations of Smile and Laughter Suppression in Social Contexts.

Vanessa Mitschke, Anne Schacht

Social dynamics are intricately shaped by the regulation of emotional facial expressions, exerting a profound influence on the quality of interactions. In a series of studies, we conducted electromyographic measurements of multiple facial muscles. Study Set 1 explores the effectiveness of inhibiting affiliative facial expressions, particularly smiles, directed towards targets associated with negative valence. Results demonstrate heightened effectiveness in inhibiting smiles when directed towards negatively valenced targets, with differential activation of the ZM muscle reflecting the suppression of positive affiliative responses. Shifting our focus to laughter, Study Set 2 delves into the consequences and mechanisms of suppressing laughter. Findings showcase a significant reduction in amusement during cognitive reappraisal (CR), while expressive suppression (ES) entirely suppresses laughter in response to mildly amusing stimuli, it did not influence the subjective sense of amusement. We further explored the impact of laughter mimicry and social appraisal, revealing the difficulty of suppressing laughter mimicry and heightened amusement in the presence of others' laughter. These findings underscore the nuanced impacts of emotional regulation strategies and emphasize the pivotal role of social context in shaping the experience of amusement. This combined exploration sheds light on the intricacies surrounding the inhibition of affiliative facial expressions and the broader social dynamics influencing the regulation of emotional facial reactions in diverse social interactions.

Location: Auditorium 1
Oral talks 17: Emotion II

Adolescent's interpersonal stress predicting ex-vivo inflammatory reactivity: moderation by emotion regulation and parasympathetic nervous activity?

Nathalie Michels, Matteo Giletta

Background: Chronic inflammation is an intermediate health outcome translating psychosocial adversities into biological risk. Meta-analyses demonstrated that childhood trauma and stress contribute to a pro-inflammatory state in adulthood. However, findings were mixed when inflammation is measured before adulthood. Methodological improvements seem necessary since the typical approach of measuring circulating inflammatory parameters brings the disadvantage of very low concentrations (i.e., floor effects, clinically irrelevant changes, detection issues) and of being a static approach. As an innovative alternative, the current study applies a recent field-friendly ex-vivo inflammatory reactivity measurement (McDade 2021).

Method: Our longitudinal Outside-In study examines how social stressors may pose risks for adolescents' health during the first three years of secondary school. Using three drops of finger-stick blood, dried blood samples were collected in 345 participants. Via ex-vivo cell culture, blood drops were incubated for 4h at 37°C with the bacterial compound lipopolysaccharide (LPS), LPS plus glucocorticoids or a control solution. The produced cytokines (IL6, TNF α , IL1) reflect inflammatory reactivity and glucocorticoid sensitivity.

Results: The procedure was successful: the bacterial trigger increased cytokine levels ± 50 times and the glucocorticoid decreased the reactivity by $\pm 60\%$. The patterns were consistent over the cytokines, but reactivity and sensitivity patterns seem distinct phenomena ($r=0.3-0.5$). Child maltreatment was related to more inflammatory reactivity, but not recovery. The same but borderline-significant trend was visible for bullying victimisation. Next, we will test the longitudinal association and the moderation by emotion regulation and heart rate variability. Later, associations with impulse inhibition (measured with emotion-based go-no-go task) will be examined.

Location: Auditorium 1
Oral talks 17: Emotion II

EMOTIONAL PROCESSING AND THE GUT-BRAIN AXIS IN YOUNG BINGE DRINKERS

Carina Carbia, John F Cryan, Sophie Leclercq, Pierre Maurage

Background: A robust connection has emerged between the gut microbiome and socio-emotional functioning across various psychiatric disorders, including alcohol use disorders. However, previous studies have focused on clinical populations and have not explored the links between cognitive emotional processes and microbiota alterations. In order to understand how such interactions emerge at the early stages of alcohol-use disorders, we explored alcohol-induced changes in microbial profile and emotional processing in a subclinical pattern of alcohol consumption, namely binge drinking.

Methods: A cohort of young individuals (N = 71, aged 18-25) underwent a neuropsychological assessment including cognitive and emotional measures, together with an alcohol use evaluation. We also obtained stool samples, as well as blood, saliva, and hair samples for inflammatory and cortisol analysis.

Results: The intensity of binge drinking habits was related to distinct microbiome alterations and difficulties in emotional recognition. Several microbiome species were linked to emotional processing, in particular to sadness recognition in the Emotional Recognition Test.

Conclusions: The associations between emotional recognition and microbiome composition further underscore the burgeoning literature on the gut microbiome's role as a regulator of emotional functioning and social cognition. Following these findings, future perspectives will be discussed focusing on the effects of stress in emotional processes and its implications for mental health.

Location: Auditorium 1
Oral talks 17: Emotion II

Unpacking the functional heterogeneity of the Emotional Face Matching Task: a normative modelling approach

Hannah Savage, Peter Mulders, Philip van Eijndhoven, Jasper van Oort, Janna Vrijssen, Indira Tendolkar, Christian Beckmann, Andre Marquand

Functional neuroimaging has contributed substantially to understanding brain function but is dominated by group analyses that index only a fraction of the variation in these data. It is increasingly clear that parsing the underlying heterogeneity is crucial to understand individual differences and the impact of different task manipulations. We estimate large-scale (N=7728) normative models of task-evoked activation during the Emotional Face Matching Task, which enables us to bind heterogeneous datasets to a common reference and dissect heterogeneity underlying group-level analyses. We apply this model to a heterogeneous patient cohort, to map individual differences between patients with one or more mental health diagnoses relative to the reference cohort and determine multivariate associations with transdiagnostic symptom domains. For the face>shapes contrast, patients have a higher frequency of extreme deviations which are spatially heterogeneous. In contrast, normative models for faces>baseline have greater predictive value for individuals' transdiagnostic functioning.

Location: Leslokaal 1.2

Oral talks 18: Interpersonal Synchrony

It Takes Two to Empathize: Inter-brain Coupling Contributes to Distress Regulation

Yarden Avnor

While extant research on empathy has made significant progress in uncovering the mechanisms underlying the responses of an observer (empathizer) to the distress of another (target), it remains unclear how the interaction between the empathizer and the target contributes to distress regulation in the target. Here we propose that behavioral and neural coupling during empathic interactions contribute to diminished distress. Thirty-seven pairs of previously unacquainted participants engaged in a five-minute face-to-face emotional sharing task, where one participant shared a distressing biographical experience with the other participant. We used functional near-infrared spectroscopy (fNIRS) to measure inter-brain coupling in the emotion regulation system, specifically the dorsolateral prefrontal cortex (dlPFC), and the observation-execution system, specifically the inferior frontal gyrus (IFG). Results indicate that during emotional sharing the target and the empathizer emotionally converge, such that the empathizer becomes sadder. Moreover, the levels of empathizers' empathy predicted both emotional convergence and target distress relief. The neuroimaging findings indicate that increased inter-brain coupling in the dlPFC and IFG predicted distress relief in the target, and more critically that inter-brain coupling in the dlPFC played a mediating role in the relationship between distress relief and the levels of empathy of the empathizer. Considering the role of the dlPFC in emotion regulation, we conclude that inter-brain coupling in this region during emotional sharing plays a key role in dyadic co-regulation of distress.

Location: Leslokaal 1.2

Oral talks 18: Interpersonal Synchrony

Spontaneous dyadic behavior predicts the emergence of interpersonal neural synchrony

Atesh Koul, Davide Ahmar, Gian Domenico Iannetti, Giacomo Novembre

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. As the origins of INS are poorly understood, we tested whether and how INS might emerge from spontaneous dyadic behavior. We recorded neural activity (EEG) and human behavior (full-body kinematics, eye movements, and facial expressions) while dyads of participants were instructed to look at each other without speaking or making co-verbal gestures. We made four fundamental observations. First, despite absence of a structured social task, INS emerged spontaneously only when participants were able to see each other. Second, we show that such spontaneous INS, comprising specific spectral and topographic profiles, did not merely reflect intra-personal modulations of neural activity, but it rather reflected real-time and dyad-specific coupling of neural activities. Third, using state-of-art video-image processing and deep learning, we extracted temporal unfolding of three notable social behavioral cues – body movement, eye contact, and smiling – and demonstrated that these behaviors also spontaneously synchronized within dyads. Fourth, we probed correlates of INS in such synchronized social behaviors. Using cross-correlation and Granger causality analyses, we show that synchronized social behaviors anticipate and in fact Granger cause INS. These results provide proof-of-concept evidence for studying interpersonal neural and behavioral synchrony under natural and unconstrained conditions. Most importantly, the results suggest that INS could be conceptualized as an emergent property of two coupled neural systems: an entrainment phenomenon, promoted by real-time dyadic behavior.

Location: Leslokaal 1.2

Oral talks 18: Interpersonal Synchrony

EEG hyperscanning recording during Perceptual Crossing experiment to study second-person neuroscience

Finda Putri

The concept of second-person neuroscience (SPN) was developed to better understand the neural response during an active, real-time, and reciprocal social interaction. One of the known methods to study SPN is the Perceptual Crossing (PC) paradigm. In this paradigm, a pair of participants interact through a minimalistic interface based on a continuous sensorimotor haptic feedback loop. PC paradigm has been applied to study the fundamental role of sensorimotor interaction in the social abilities of different populations. However, the brain mechanisms that underlie the behaviour during PC have never been explored and the information about participants' subjective experience during PC is rarely measured. This study applied EEG hyperscanning on PC experiment performed by two individuals, along with subjective experience and behavioural data measurements. The goals are to identify distinct brain signatures that occur during PC, from the perspective of single-brain and inter-brain, and to find the relationship between those signatures and the subjective experience and behavioural measures. This study will provide information regarding the brain's cortical mechanisms behind the PC paradigm, which is expected to advance the field of SPN.

Saturday, May 25th 2024 // 3:00pm - 4:30pm

Location: Leslokaal 1.2

Oral talks 18: Interpersonal Synchrony

Rhythms of interaction – the timescales of social synchrony and why they matter

Antonia Hamilton

Coordinated behaviours, where people do roughly the same thing at the same time, occur on many different timescale throughout human life, from millisecond synchronization in a piano duet to turn taking in conversation, and from daily meal times to annual religious festivals. Our neuroscientific measures for tracking these coordinated behaviours are also tied to particular timescales ranging from milliseconds (EEG) to seconds (fNIRS) and longer (neuroendocrinology). This talk will take a big-picture approach and ask how we can use neuroscientific methods at different timescales to track and understand behaviours at different timescales. I will argue that not all timescales are the same, and that slower mechanisms may be very important in the real world but have been relatively neglected in research studies. Going deeper, I will consider what kind of cognitive models and information-processing models might apply to different types of data collected and different timescales, and whether it will be possible to have a unified understanding of the mechanisms of social synchrony in the future.

Saturday, May 25th 2024 // 3:00pm - 4:30pm

Location: Leslokaal 1.3

Oral talks 19: Decision making II

How much data are needed to estimate computational models of decision-making? Presenting the COMPASS toolbox

Pieter Verbeke

How much data are needed to obtain useful parameter estimations from a computational model? The standard approach to address this question is to carry out a goodness-of-recovery study. Here, the correlation between individual-participant true and estimated parameter values determines when a sample size is large enough. However, depending on one's research question, this approach may be suboptimal, potentially leading to sample sizes that are either too small (underpowered) or too large (overcostly or unfeasible). We formulate a generalized concept of statistical power and use this to propose a novel approach toward determining how much data is needed to obtain useful parameter estimates from a computational model. By performing simulations, we provide some insights in how to optimize data collection when one aims to use computational models in the analyses. More importantly however, we will also present a tutorial on a Python-based toolbox (COMPASS) that allows one to tailor power computations to their own research idea and design. A first version of the toolbox implemented the Rescorla-Wagner model of learning and decision-making. Recently, we also extended our approach to the drift diffusion model.

Location: Leslokaal 1.3

Oral talks 19: Decision making II

Action planning and execution cues influence economic partner choice

Luke McEllin

Prudently choosing who to interact with and who to avoid is an important ability to ensure that we benefit from a cooperative interaction. While the role of others' preferences, attributes, and values in partner choice have been established, much less is known about whether the manner in which a potential partner plans and implements a decision provides helpful cues for partner choice. We used a partner choice paradigm in which participants chose who to interact with in the Prisoners' Dilemma. Before choosing a cooperation partner, participants were presented with information about the potential partners' decision-related actions in another round of the Prisoners' Dilemma. They received either information about the potential partners' planning during decision making (i.e., decision-time; Experiment 1) or action execution during decision implementation (i.e., movement directness; Experiment 2). Across both games, participants preferred to interact with those who planned actions quickly or executed actions with direct and smooth movements, indicating that they were cooperating confidently and without deliberation. This demonstrates that action cues present in either the planning or implementation of economic decisions influence partner choice. We discuss implications of this finding for human decision-making and perception-action coupling in action understanding.

Location: Leslokaal 1.3

Oral talks 19: Decision making II

Neurocomputational mechanisms of self-benefitting vs pro-environmental behavior

Boryana Todorova, Kimberly Doell, Ronald Sladky, Claus Lamm

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 of pro-environmental behavior. Across two studies, we adapted a well-established paradigm developed to study effortful prosocial behavior to investigate pro-environmental behavior. In study one, 74 participants engaged in a decision-making task, where they could earn a varying amount of money for themselves or a pro-environmental organization by investing a varying amount of physical force (measured by a hand-grip device). Confirming our hypothesis, based on research on prosocial decision-making, the results show that participants devalue rewards for the environment more strongly than rewards for themselves. In study two, participants engage in the same decision-making task while undergoing fMRI with the goal of studying the neural underpinnings of the decision process. Data collection and analysis of the second experiment is still in progress and the results will be reported at the conference. Using region of interest analysis we will compare activation for areas associated with the tracking subjective value (e.g. anterior insula, ventromedial prefrontal cortex) for self vs environmental decisions. In addition, we will investigate how that activation relates to participants' real-life behavior, including everyday pro-environmental behavior and willingness to support climate policies. Adapting such a social neuroscience approach in the climate domain by combining neuroimaging and behavioral data helps us understand the neurocomputational processes underlying pro-environmental decision-making and identify barriers preventing people from engaging in more sustainable practices.

Location: Leslokaal 1.3

Oral talks 19: Decision making II

Improving self-control: the effect of role models' observation on near and far transfer

Mina Movahedi, Gayannée Kedia, Katja Corcoran, Amelie Baitinger, Clemens Nussgraber

Self-control is pivotal for a happy and healthy life. Psychologists have proposed numerous methods to improve self-control (e.g., goal setting), but these methods have one major drawback: they are effortful and thus ill-suited for people with low self-control. Here, we explore a less demanding approach: Observational learning.

We tested whether observing a role model exerting self-control improves observers' self-control on the same task (near transfer) and on a different task also requiring self-control (far transfer). Across three studies, participants witnessed role models making intertemporal choices (e.g., \$25 now or \$55 in a week) and then completed self-control tasks.

In Study 1 (online, N=270), we found a significant influence of the role model on the near transfer task and a marginal effect on the far transfer task. In Study 2 (online, N=279), we made the role models more inspiring and found a significant influence for both near and far transfers. In Study 3 (N=179), we repeated the previous studies in the lab with low self-control participants only and used a new far transfer task. We found a significant influence of role model observation on the near transfer task, but not on the far transfer task.

These results demonstrate that observing a role model can enhance the observer's self-control, particularly in tasks resembling the model's behavior. However, further research is needed for distant transfer tasks. Thus, overall, observational learning presents a promising avenue for improving self-control, especially among individuals with lower levels of it.

Location: Leslokaal 1.3

Oral talks 19: Decision making II

Sharing is caring: integrating suprapersonal metacognition during collaborative decision-making.

Gaia Corlazzoli, Kobe Desender, Wim Gevers

When collaborating on a task, people improve their performance by sharing their confidence and selecting the most confident partner (Bahrami, 2010). However, while doing a task, we experience several subjective experiences. In Corlazzoli et al., 2023, besides confidence, participants also considered experiences of subjective physical effort and reward satisfaction. The current study aimed to understand how people communicate subjective experiences with others during joint decision-making.

We tested two tasks. In both experiments, participants had to perform a trial privately, and then interact with a partner. Finally, they decided whether the trial would be given to a third partner, whose success determined group benefit. In Experiment 1, participants interacted via verbal discussion until a joint agreement was reached. In Experiment 2, participants interacted by seeing their partner's subjective ratings on the screen.

Results showed that participants integrated both their own metacognitive experiences as well as those of other participants when deciding which trial to give to the third participant. Participants seem to always relate the partner's experiences to their own, by computing a difference between the two corresponding experiences. Moreover, when they are free to discuss, results show that dyads converge on a limited set of topics and expressions.

We provide with first insights into how people make decisions based on integrating other people's subjective judgments with their own experiences when deciding on other people's investment of cognitive control. Results suggest participants make joint decisions by integrating their own and their partner's subjective experiences regardless of the nature of the interaction.

Location: Leslokaal 3.2
Oral talks 20: Empathy

Training self-other distinction: Effects on emotion regulation, empathy, and Theory of Mind

Juan Carlos Oliveros, Idalmis Santiesteban, José Luis Ulloa

Navigating our social environment requires the ability to distinguish ourselves from others. Previous research suggests that training interventions have the potential to enhance the capacity for self-other distinction, which then may impact various socio-cognitive domains, including imitation-inhibition, visual perspective-taking, and empathy. Importantly, empirical research on the role of self-other distinction in emotion regulation remains scarce. In this study, we aim to investigate the impact of training self-other distinction on emotion regulation and also replicate findings on empathy and the attribution of mental states to others. Using a pre-post design, participants (N = 104) were assigned to either imitation-inhibition or general inhibitory control training. Compared to general inhibitory control training, participants trained to increase self-other distinction in the motor domain displayed a significant increase in post-test emotion regulation levels compared to pre-test levels, indicating that imitation-inhibition training enhanced emotion regulation skills. Notably, emotional interference remained unaffected by either form of training. Both training interventions resulted in diminished self-reported empathic concern, while only general inhibitory control training led to a reduction in personal distress. Moreover, neither type of training had an impact on self-reported perspective-taking or Theory of Mind performance. This study provides novel empirical evidence of the positive impact of imitation-inhibition training on emotion regulation. Furthermore, our findings make significant contributions to the advancement of research in this area and offer further support for the advantages of behavioural training as a methodological approach to studying socio-cognitive abilities.

Location: Leslokaal 3.2
Oral talks 20: Empathy

Moving, feeling and thinking together: A “fine cuts” approach toward understanding empathy and imitation using self-reports, behavioral and neural measurements

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Empathy is a multidimensional concept encompassing distinguishable affective and cognitive facets, that are often not well delineated. With renewed interest in embodiment theory, recent research aims to integrate and map motor components of social interaction, such as temporal (i.e., synchrony) and spatial (i.e., imitation) behavioral matching, onto the empathy framework. However, distinctive facets of behavioral matching are conflated or studied separately, and it is unclear how they map onto affective, cognitive and motor empathy facets, challenging the establishment of a common theoretical framework of shared mechanisms.

Addressing this gap, a study was conducted where participants (N = 34) completed self-reports of affective, cognitive and motor empathy traits, and performed the Automatic Imitation Task (AIT), during which electroencephalographic (EEG) activity was recorded. Event-related potentials (ERPs, P3a/P3b) were measured in response to neutral, congruent and incongruent imitation cues, as an index of conflict monitoring processes. Mixed models tested the interaction of AIT cues and their temporal sequences with empathy traits, on accuracy, reaction times and ERP amplitudes.

Behavioral patterns revealed (i) negative associations of affective and motor empathy with AIT accuracy; (ii) an interference effect of AIT congruent cues only for cognitive empathy (perspective taking); and (iii) distinct associations of affective and cognitive empathy with temporal sequences. EEG analyses revealed (i) lower ERP amplitudes for neutral cues and cue repetition and (ii) distinct frontoparietal activation for affective and cognitive empathy facets. Overall, this study advocates a “fine cuts” approach for delineating shared and distinctive neural components of empathy and behavioral matching.

Location: Leslokaal 3.2
Oral talks 20: Empathy

Dissociable role for the right inferior frontal gyrus in empathic responses to social and physical pain

Andrew Martin

Competing theories have been proposed for the relationship between empathic responses for social and physical pain. One theory states that common neural processes are recruited for both, whilst the other suggests at least partially unique neural processes. Using focal transcranial direct current stimulation (f-tDCS) we aimed to provide causal evidence for a dissociable role of two key hubs of the social brain in relation to rating the extent of physical or social pain experienced by others. Fifty-two healthy young adults were stratified to receive anodal stimulation to either the right inferior frontal gyrus (rIFG) or the dorsomedial prefrontal cortex (dmPFC), and received both active and sham stimulation using a repeated measures, crossover, sham-controlled, double-blinded design. Stimulation was administered using a one-channel DC stimulator and two concentric rubber electrodes. During stimulation, participants were required to indicate the extent of pain experienced in images depicting social or physical pain and non-painful control images. Anodal stimulation to the rIFG increased the rating of pain in images depicting physical pain and decreased the rating of pain in those depicting social pain. Stimulation to the dmPFC had no effect on pain ratings for either physical or social pain. The results provide causal evidence for dissociable neural processes responsible for rating physical and social pain in others.

Location: Leslokaal 3.2
Oral talks 20: Empathy

Interoceptive predictive processing in an adaptive empathy task

Vassilis Kotsaris

Empathy is a multifaceted social process where critical for an effective empathic response is the flexible adaptation to other's needs. Here, we examined how interoceptive inference affects learning and decision-making in an adaptive empathy task measuring the Heart Evoked Potential (HEP) as an index of interoceptive prediction and attention. We employed a social reinforcement learning task where participants had to choose among two options (distraction and reappraisal) to alleviate the distress of a virtual character whose preferred emotion regulation approach was changing, at different rates, throughout the task. Using a hierarchical Bayesian learning model (HGF), we examine whether learning and decision-making parameters are correlated with HEPs on a trial-by-trial fashion to study the influence of interoceptive processing on adaptive empathic decision-making and whether this relationship is affected by individuals' social skills and emotion regulation abilities. So far, analyses of behavioural data revealed that similar and more adaptive learning among participants with higher empathic traits and emotion regulation difficulties and less adaptive learning among those with increased communication difficulties. Relationships between HEPs and behaviour may elucidate how brain-body communication influences social interactions under different uncertainty conditions, and reveal aberrant interoceptive predictive processing in people with socio-affective difficulties.

Saturday, May 25th 2024 // 3:00pm - 4:30pm

Location: Leslokaal 3.2

Oral talks 20: Empathy

Moral Conformity: on the interplay among Sense of Agency, cognitive conflict and empathy in collaborative decision-making

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The existing literature has demonstrated the influential role of displacement of responsibility in individuals, such when acting under coercion, in the context of moral decision making. However, the neural underpinnings of diffusion of responsibility and conformity, when acting collaboratively with a co-agent while maintaining an egalitarian subdivision of power, have received limited attention. This study aims to address this gap by delving into the neuro-cognitive processes implicated with collaborative moral decision-making, such as cognitive conflict, empathy, and sense of Agency (SoA) over the action, exploring possible associations with the degree of conformity with the partner. To this aim we run an experiment where two agents could sequentially decide whether to inflict a series of painful shocks on a third person in exchange for monetary reward. Brain activity of the 2nd agent making the decision was measured with EEG. Preliminary findings indicate an inclination to conform to one's partner choices, both at the single-trial level and as a general tendency and associated with modulation of SoA. At the brain level, we found no difference in empathy responses when giving single vs double shocks, while we found it for the presentation of single vs double reward cues. In addition, deciding to administer a shock jointly with the partner resulted in weaker cognitive conflict-related brain oscillations. These results reveal a pronounced inclination towards conformity in a context of collaborative moral decision-making, a process sustained by modulation of SoA, attenuated cognitive conflict and associated with a differential elaboration of other pain and own benefit.