Neuro Cog2023

ULB

November 23-24, 2023

ABSTRACT BOOK

Program

Program Day 1 - November 23, 2023

09:00 – Registration (+ Badge pick-up and coffee)

WIFI access network [CFWB_Guest] Password [WIFI-GUEST@CFWB]

09:30 – Welcome

09:45 – Yana Fandakova - University of Trier, Germany

Cognitive control contributions to learning and memory: Lifespan development and neural plasticity

11:00 – Coffee break

11:30 – Masud Husain - University of Oxford, United Kingdom

When the spark goes out: The neurology of apathy and motivation

12:45 – Lunch and Posters

Guided Poster Session 1: 13:15-14:15

14:45 – Oral presentations Session 1

- **Talk 1.1. Charlotte Anckaert et al. (ULB)** Sleep deprivation increases belief update and suppresses confirmation bias in decision tasks
- **Talk 1.2. Matthijs Moerkerke et al. (KULeuven)** Chronic oxytocin administration does not rescue reduced neural sensitivity towards emotional faces in autism
- **Talk 1.3. Michele Fornaciai (UCLouvain)** Perceptual history biases entail sensory modality- and dimension-specific mechanisms
- **Talk 1.4. Paradeisios Alexandros Boulakis et al. (ULiege)** Age-dependent attentional style and arousal regulate the reportability of spontaneous mental states

- **Talk 1.5. Elena Eccher et al. (Universita di Trento)** A universal left-to-right bias in number-space mapping across ages and cultures

16:00 – Coffee Break

16:30 – Gaël Chételat - Université de Caen, France

Preserve your mental health to protect your brain : background, mechanisms and evidence

17:45 – End of the day

19:00 – Social dinner

Social dinner (sold out) is held at the University Foundation, Egmontstraat / Rue d'Egmont 11 - 1000 Brussel / Bruxelles

Program Day 2 - November 24, 2023

9:00 – Giorgio Vallortigara - Università di Trento, Italy

A Brain for Animacy: from Animal Models to Human Babies

10:15 – Coffee break

10:45 – Emily Jones - University of London, United Kingdom

Uncovering developmental paths to neurodevelopmental conditions: Dynamics over time

12:00 – Lunch and Posters

Guided Poster Session 2: 12:30-13:30

14:00 – Oral presentations Session 1

- **Talk 2.1. Roberta Pia Calce et al. (UCLouvain)** Crawling from noise to knowledge: Development of sound categorization in infancy
- **Talk 2.2. Muhammet Ikbal Sahan et al. (UGhent)** Oculomotor replay as a retention mechanism for visuospatial information in short-term memory
- **Talk 2.3. Sylvie Nozaradan et al. (UCLouvain)** Infants show enhanced neural activity to the musical beat beyond low-level sensory features
- **Talk 2.4. Soleane Gander et al. (ULB)** Theta-band functional connectivity processes involved in the dynamic formation of new declarative representations in school-aged children
- **Talk 2.5. Ward Deferm et al. (KULeuven)** Microstructural alterations in white matter tracts involved in social emotional processing after preterm birth

15:15 – Coffee Break

15:45 – Victoria Leong - University of Cambridge, United Kingdom

Neural Sociometrics: Precision assessment of parent-child brain-behaviour interaction dynamics

17:00 – Best Poster prize and closing of the conference

Keynote talk

Yana Fandakova

(University of Trier, Germany)

Cognitive control contributions to learning and memory : Lifespan development and neural plasticity

Ensuring efficient learning and memory is not an easy feat: we need to select what and how to learn, acquire new information so that it can be retrieved when needed in the future, and flexibly adapt when circumstances change. Cognitive control processes play a key role for scaffolding learning and memory by monitoring and regulating information processing in line with our goals and task demands. These processes are implemented by a core set of frontal and posterior parietal brain regions that undergo protracted development across childhood and adolescence, and decline in old age. I will first highlight work demonstrating that changes in monitoring and control across childhood and adolescence contribute to episodic memory development. Next, I will discuss how senescent changes in the neural underpinnings of monitoring and control contribute to older adults' memory difficulties. Finally, I will outline ongoing work probing the neural plasticity of the cognitive control network in children. Together, these findings further our understanding how the neurocognitive development of cognitive control shapes learning and memory across the lifespan.

Keynote talk

Masud Husain

(University of Oxford, United Kingdom)

When the spark goes out. The neurology of apathy and motivation

Disorders of motivation are common across brain disorders. One extreme is the syndrome of pathological loss of motivation – apathy. Unfortunately, we understand very little about the mechanisms underlying this condition. In this talk, I'll put forward a conceptual framework to understand apathy by considering the processes that normally underlie motivated, goal-directed behavior. In particular, I'll focus on the ability to generate options for behavior and effort-based decision making for rewards. Several lines of evidence suggest that when we make decisions about how much effort we might invest to initiate actions, we weigh up the costs involved against the potential rewards to be obtained. Functional imaging in healthy people reveals both medial frontal and ventral striatal involvement when we make such decisions. In patients with apathy, this evaluation is altered. They show blunted sensitivity to rewards and less inclination to invest effort for low rewards. Both these factors can be improved by dopaminergic medication in some cases. These findings support the view that it is possible to provide a mechanistic account of apathy and also obtain better understanding of brain systems underpinning normal human motivation to generate actions.

Keynote talk

Gaël Chételat

(Université Caen Normandie, France)

Preserve your mental health to protect your brain : background, mechanisms and evidence

Depression stands as the second most significant risk factor for Alzheimer's disease within aging populations. Collectively, anxiety, rumination, and depression, often accompanied by sleep disturbances and cognitive impairments, contribute to reduced mental health and overall well-being in aging individuals, elevating the susceptibility to degenerative diseases. Remarkably, even at preclinical stages, anxiety and depressive symptoms manifest structural brain changes, with variations contingent on factors such as sex, age, and clinical progression. In the current era, marked by the emergence of non-pharmacological interventions and lifestyle modifications, meditation has emerged as a promising avenue to enhance mental health and well-being among aging populations while mitigating these adverse psychoaffective risk factors, including anxiety and depression. The Medit-Ageing model has been introduced to elucidate the underlying psychological mechanisms through which meditation exerts its influence on aging. This model delineates the specific meditation practices (mindfulness, loving-kindness, and compassion meditation), the cognitive processes involved (attention control, metacognitive monitoring, and the cultivation of prosocial capacities), as well as the pathways activated (downregulation of negative automatic thought patterns and upregulation of positive automatic thought patterns), collectively contributing to a positive

impact on the aging process. Moving beyond theoretical concepts, we will present the preliminary findings of the H2020 European project, Medit-Ageing, which investigates the effects of meditation interventions on aging populations through two randomized controlled clinical trials, namely Age-Well and SCD-Well.

Keynote talk

Giorgio Vallortigara

(Università di Trento, Italy)

A Brain for Animacy : From Animal Models to Human Babies

To what extent are filial responses the outcome of spontaneous or acquired preferences? The case of domestic chicks (Gallus gallus) illustrates the connection between predisposed and learned knowledge in early social responses. In the absence of specific experience, chicks prefer to approach objects that are more similar to natural social partners (e.g. they prefer face-like configurations, biological motion, self-propelled objects and those that move at variable speed). Spontaneous preferences are complemented by filial imprinting, a powerful learning mechanism that enables chicks to quickly learn the features of specific social partners. While neurobiological studies have clarified that the substrates of spontaneous and learned preferences are at least partially distinct in chicks, evidence shows that spontaneous preferences might orient and facilitate imprinting on animate stimuli, such as the mother hen, and that hormones facilitate and strengthen preferences for predisposed stimuli. Subpallial regions of the so-called Social Behaviour Network (including e.g. lateral septum and nucleus teaniae) seem to be involved in spontaneous preferences, whereas pallial regions in learning-plasticity associated with imprinting. Preferences towards animate stimuli are observed in human neonates as well. The remarkable consistency between the perceptual cues attended to by newborn babies and naïve chicks suggests that the attentional biases observed in babies are unlikely to result from very rapid post-natal learning, and confirms that research on precocial

non-human species can inform and guide human infant research with regards to both typical and atypical development. This has potentially important biomedical implications, opening new possibilities for the early detection of subjects at risk for autism spectrum disorders. We show how the parallel investigation of predispositions in naïve chicks and human infants, both benefiting from contact with social partners since the beginning of life, has greatly improved our understanding of early responses to social stimuli at the behavioural and neurobiological level.

Keynote talk

Emily Jones

(University of London, United Kingdom)

Uncovering developmental paths to neurodevelopmental conditions: Dynamics over time

Autism is a neurodevelopmental condition that occurs in around 2% of people, and can be associated with differences in social interaction, communication and interests. Autism is connected with genetic changes that are present from conception, but is often not identified until children are in school. Prospective longitudinal studies that follow infants from near birth to childhood can reveal the earliest developmental changes that precede the later emergence of autistic traits. Here, I describe a series of studies examining some of the earliest changes in infants with later autism and their interrelation over both short and long timescales. Within prospective studies, we see differences in sensory reactivity across touch, audition and visual domains, and changes in sleep that precede an autism diagnosis. Sensory differences are related to sleep differences, and both may relate to emerging trajectories of fearfulness and later anxiety, indicating they may be important targets for supportive interventions. Further, changes in sleep may be linked to alterations in daytime brain states that have been associated with longer-term cognitive development. Taken together, examining changes in early sensory development and sleep may provide important insights into the early development of children with neurodevelopmental conditions.

Keynote talk

Victoria Leong

(University of Cambridge, United Kingdom)

Neural Sociometrics: Precision assessment of parent-child brain-behaviour interaction dynamics

During early life, healthy neurodevelopment depends on warm, responsive and closely-coordinated social interactions between infants and caregivers. These rich multidimensional experiences act through multiple sensory and motor pathways to orchestrate healthy maturation of the neonatal brain, mind and body. Conversely, adverse early life experiences (including abuse or neglect) seed vulnerabilities for poor cognition and emotional instability throughout the lifespan. Despite the pivotal role played by caregiver interactions during early development, we still lack precision tools and models that can accurately and comprehensively capture the complex dynamics within the child's "interactome". Here, I will discuss neural sociometrics – real-time multi-sensor high-dimensional imaging of adult-infant dyadic social interactive behaviour and neurophysiology - as a deep phenotyping tool for early screening and precision intervention. Early risk identification and mitigation, paired with precision therapeutics, could fundamentally alter a child's development trajectory toward lifelong mental wellbeing and productivity.

Oral presentation 1.1

Sleep deprivation increases belief update and suppresses confirmation bias in decision tasks

Charlotte Anckaert, Wim Gevers, Philippe Peigneux

Université Libre de Bruxelles

Processing new information and updating beliefs are crucial in current information-rich societies for accurate understanding and informed decision-making. The impact of sleep deprivation on existing beliefs and the extent of belief changes is still debated. Despite its prevalence, the impact of sleep deprivation on cognitive functions remains relatively understudied, with mixed findings. Theoretically, sleep deprivation may diminish motivation for deeper cognitive processing, leading individuals to adopt or ignore the beliefs of others, or rather facilitates modification of existing beliefs, with greater ease due to fatigue. In this study, 36 participants completed a binary decision task after a night of normal sleep and after a night of sleep deprivation, counterbalanced. Results disclosed a significant impact of sleep deprivation on belief changes and confidence updates: as compared to after a normal night of sleep, sleep-deprived individuals doubled their belief changes. Also, lower confidence led to more belief changes regardless of sleep condition, showing an impact of initial confidence levels. After a normal sleep night, a confirmation bias emerged with a boost in confidence when the partner agreed, a bias effect that was not present in the sleep-deprived condition. Results confirm sleep deprivation's role in altering beliefs while considering initial confidence. High confidence led to selective processing of choice-consistent information and integration of confirmatory evidence, but this was disrupted under sleep deprivation, leading to increased belief changes and no confirmation bias.

Oral presentation 1.2

Chronic oxytocin administration does not rescue reduced neural sensitivity towards emotional faces in autisms

Matthijs Moerkerke, Nicky Daniels, Laura Tibermont, Stephanie Van der Donck, Tiffany Tang, Jellina Prinsen, Jean Steyaert, Kaat Alaerts, Bart Boets

KU Leuven, Center for Developmental Psychiatry & Leuven Autism Research Consortium (LAuRes), Belgium

Rapid and accurate processing of emotional facial expressions is crucial for social development and is often a challenge in autism. Intranasal oxytocin administration is increasingly explored as a treatment for improving social behaviour, possibly by enhancing sensitivity for social cues (e.g. faces) or by reducing social anxiety. However, mechanistic insight in the neural effects of oxytocin, especially the impact of chronic treatment, remains largely unexplored. We therefore performed a randomized, placebo-controlled, multiple-dose oxytocin clinical trial (4 weeks, 24IU daily) in 8-to-12-year-old autistic boys and girls (n=29 oxytocin, n=32 placebo), and assessed effects immediately post-treatment and after a 4-week follow-up. Frequency-tagging EEG was used to robustly quantify neural sensitivity towards happy and fearful facial expressions. Prior to the intervention we applied the frequency-tagging EEG technique in control children (n=39), to compare their neural sensitivity with that of autistic children. We observed significantly reduced neural sensitivity towards emotional faces in autism compared to controls. Upon nasal spray administration, autistic children showed increased neural sensitivity at post and follow-up sessions in the placebo group, likely due to implicit learning. Strikingly, in the oxytocin group, neural sensitivity remained unchanged post-spray, possibly dampening this implicit learning effect. At follow-up neural sensitivity increased also in the oxytocin group, comparable to the effect seen in the placebo group. So contrary to the main hypothesis that oxytocin would heighten and possibly rescue neural responses towards emotional faces in autism, we see that chronic oxytocin administration further dampens these responses, possibly in line with oxytocin's social anxiety reducing effect.

Oral presentation 1.3

Perceptual history biases entail sensory modality- and dimension-specific mechanisms

Michele Fornaciai

Institut de recherche en sciences psychologiques (IPSY), Université catholique de Louvain

Vision is not uniquely based on the sensory input received by our eyes at any given time, but also depends on what we have seen just a moment ago. The integration of past ("perceptual history") and current sensory information, although potentially beneficial, has been shown to lead to systematic biases. Namely, a current stimulus may appear to be more similar to a previous one than it actually is. These biases are ubiquitous in vision, but their nature and underlying mechanisms are currently unclear. In this work, we tested and compared perceptual history effects across different sensory modalities and stimulus dimensions. By doing so, we assessed whether perceptual history effects in different contexts could be traced back to a centralised cognitive mechanism, or to independent sensory mechanisms. First, the results demonstrate that perceptual history effects in vision and audition show different patterns of selectivity for the properties of the stimuli (e.g., spatial position, colour, pitch). Second, perceptual history effects measured in different stimulus dimensions (duration and numerosity) show a different sensitivity to the interval between successive stimuli. Finally, we demonstrate that while the bias generalises across widely different stimuli within a sensory modality, it does not work across different modalities (vision and audition). Overall, these results suggest that the implementation of perceptual history involves relatively low-level sensory pathways specific for different sensory modalities and stimulus dimensions, showing different properties. In turn, this supports the idea that perceptual history affects perception directly, rather than affecting post-perceptual cognitive processes like decision making.

Oral presentation 1.4

Microstructural alterations in white matter tracts involved in social emotional processing after preterm birth

Ward Deferm [1], Tiffany Tang [1], Matthijs Moerkerke [1], Nicky Daniels [2], Stephanie Van der Donck [1], Kaat Alaerts [2], Jean Steyaert [1], Gunnar Naulaers[3], Els Ortibus [4], Bart Boets [1]

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[2] Neuromotor Rehabilitation Research Group, KU Leuven, Belgium
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[4] Child Neurology – Rehabilitation, UZ Leuven & Center for Developmental Disorders, Belgium

Preterm-born children have an increased risk of developing social emotional difficulties. A possible neural substrate for these social 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 social emotional processing (i.e., IFOF, SLF I, SLF II, SLF III, UF, ILF) after preterm birth. We obtained diffusion MRI scans of 39 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 which segments white matter tracts more accurately than previous software. Differences in fractional anisotropy (FA) along the tracts were investigated and exploratory correlations were performed with the SRS-2, a questionnaire assessing social functioning. 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 a posterior portion of the left SLF II. 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. Contrary to previous studies, no significant differences were found in the bilateral ILF, IFOF and UF. By using TractSeg we were able to accurately describe in which components (I, II, III) of the SLF FA was reduced, this was not possible in previous studies.

Oral presentation 1.5

A universal left-to-right bias in number-space mapping across ages and cultures

Elena Eccher[1†*], Mathilde Josserand[2†], Serge Caparos[3,4], Esther Boissin[5], Marco Buiatti[1], Manuela Piazza1[‡*], Giorgio Vallortigara1[‡*]

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Number and space are inherently related. For decades, authors have collected evidence showing that numbers are aligned to a so-called “mental number line”, which is malleable and affected by cultural factors. However, preverbal humans and non-human animals also map numerosities into space, in a consistent left-to-right direction. These contrasting pieces of evidence raise the question of whether Space Number Associations (SNA) are culturally or biologically determined. Here, we investigated Italian adults, Italian preschoolers, and Himba adults to determine whether cultural influences are necessary for SNA to emerge. We found that, when explicitly asked to order numerosities, only Italian adults showed a consistent left-to-right preference, while preschoolers and Himba adults did not have a consistent preference for one direction or the other. On the other hand, in a numerosity comparison task, all groups performed better when small numerosities were presented in the left hemispace. These results suggest that SNA is not a unique phenomenon, but rather is dissociable in two components: a universal one, biologically predisposed and left-to-right oriented, and an acquired one, culturally dependent and not fixed in orientation

Oral presentation 2.1

Crawling from noise to knowledge: Development of sound categorization in infancy

Roberta P. Calce[1], Diane Rekow[2,3], Francesca M. Barbero[1], Siddharth Talwar[1], Anna Kiseleva[2], Bourgaux Laura[6], Mattioni Stefania[7], de Heering Adélaïde[6], Arnaud Leleu[2,] Olivier Collignon[1,4,5].

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Giving meaning to the extremely rich and dynamic sensory world is a fundamental matter in our daily lives. During development, infants need to progressively learn to group the vast information that surrounds them into coherent and meaningful perceptual classes. Without perceptual categorization, each entity in the world would be perceived as unique, leaving the observer overwhelmed by the sheer diversity of what they experience in their environment. While the development of categorization has been widely investigated for vision, suggesting early neural specialization for visual categories, little is known about the emergence of sound categorization. Whether and when different acoustic and categorical features of sounds are represented in the infant brain remains therefore elusive. In a first study, we focus on the investigation of voice categorization in the infant brain using Fast Periodic Auditory Stimulation (FPAS) combined with electroencephalography (EEG), bringing forth robust evidence of voice-selective response in the 4-month-old infant brain over temporal electrodes, similar to adults. In a second study, we further explore auditory object representation of several categories using multivariate pattern analysis (MVPA)

applied to EEG data in a group of 4- to 7- month-old infants. Preliminary results show similarities and differences in the time course of multiple auditory object representation in the developing as compared to the adult brain. Overall, our findings demonstrate categorical response in the infant brain and highlight (dis)similarities with the mature brain response, shedding new lights on how sounds are represented during the first months of life.

Oral presentation 2.2

Oculomotor replay as a retention mechanism for visuospatial information in short-term memory

Muhammet Ikbal Sahan [1,2], Roma Siugzdaite [2], Sebastiaan Mathôt [3], and Wim Fias [2]

[1] Erasmus University Rotterdam
[2] Ghent University
[3] University of Groningen

The human eye scans visual information by following a series of fixations forming scanpaths. Analogous to these scanpaths during the process of actual "seeing", we investigated whether similar scanpaths are also observed while subjects are "rehearsing" stimuli in visuospatial short-term memory. Participants performed a continuous recall task in which the precise location and the color of serially presented discs were to be rehearsed during a retention phase and later reproduced either the precise location or the color of a probed item. In two experiments, we varied the direction along which the items were presented and investigated whether scanpaths during rehearsal followed the same scanpaths of encoding. Eye movements were continuously tracked and analyzed using sequence analysis tools comparing sequences of fixations for recurring patterns of eye movements. In both experiments, we confirmed the hypothesis that the eyes follow similar scanpaths during encoding and rehearsal. Specifically, we observed that participants re-fixated the memorized locations they saw during encoding, and more interestingly, the precision and the patterns with which these locations were re-fixated were also associated with lower recall errors. Our findings support an attention-based rehearsal mechanism whereby eye movements not only indicate where spatial attention is oriented, but also reveal how spatial attention shifts during visuospatial memory maintenance. We conclude that this retrospective scanning during rehearsal provides a promising novel approach to get insights into the online attentional processes involved in the mental space.

Oral presentation 2.3

Infants show enhanced neural activity to the musical beat beyond low-level sensory features

Tomas Lenc, Vargese Peter, Caitlin Hooper, Peter E. Keller, Denis Burnham, Sylvie Nozaradan

Institute of Neuroscience (IONS), Université catholique de Louvain (UCLouvain), Belgium; MARCS Institute for Brain, Behavior and Development, Western Sydney University (WSU), Australia
Center for Music in the Mind, Aarhus University, Denmark

Across cultures, humans show a spontaneous ability to perceive and move to a periodic pulse-like beat when listening to the rhythm of music. Importantly, this ability is observed in humans irrespective of the salience of the beat in the acoustic stimulus, which indicates that beat perception might rely on high-level neural processes. However, the developmental trajectory of these processes remains largely unknown. Here, we recorded the electroencephalogram (EEG) of 20 healthy 5- to 6-month-old infants, while exposed to rhythms known to induce perception of the beat consistently across Western adults. As adults, infants showed enhanced representations of beat periodicities in their EEG responses to the rhythms, irrespective of the salience of the beat in the audio signals. These findings indicate a capacity to generate endogenous representation of the beat beyond low-level acoustic features that is already present soon after birth. These high-level neural processes could thus set the stage to further guide movement coordination in music later over the lifespan.

Oral presentation 2.4

Theta-band functional connectivity processes involved in the dynamic formation of new declarative representations in school-aged children

Soléane Gander [a,b], Anna Peiffer [a,b], Vincent Wens [b], Peter Simor [a], Philippe Peigneux [a], Xavier De Tiège [a,b], Gaétane Deliens [a] and Charline Urbain [a,b]

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Introduction. Recent evidence suggests a role of sleep in the long-term reorganization of declarative memory-related brain networks in children. In parallel, specific theta-band (4-8 Hz) brain connectivity (FC) processes have been associated with successful memory formation. We hypothesized that theta-band FC (i) at rest and (ii) during memory retrieval will underlie declarative memory formation in children and that (iii) sleep will have a specific impact on the delayed reorganization of these FC processes.
Methods. Magnetoencephalography (MEG) was used in 27 children (mean±SD age: 10.04±1.06 years) to investigate FC at rest (S1) and during immediate (S2) and delayed (S3) retrieval of new declarative information, separated by 90 min of daytime sleep (Sleep Group, n=15) or wakefulness (Wake Group, n=12). Theta-band FC was estimated through power envelope correlation (PEC, for resting-state FC (rsFC) at S1) or phase locking value (PLV, for task-based FC at S2 and S3) and statistical analyses were conducted using network-based statistic (NBS).
Results. Positive correlations were found between theta-band rsFC (S1) within two fronto-temporo-occipital networks and immediate retrieval performance at S2 ($p_{corr}<0.02$). The immediate retrieval (S2) was itself associated with stronger theta-band FC (compared to baseline) in a widespread antero-posterior network ($p_{corr}<0.01$). Finally, theta-band FC occurring at delayed retrieval (S3) was stronger within a bilateral fronto-temporo-parietal network in the sleep compared to the wake group ($p_{corr}<0.03$).
Discussion. These results suggest that declarative memory formation in children critically rely on a dynamic modulation of theta-band FC processes, with sleep having a specific impact on the reorganization of associated mechanisms.

Oral presentation 2.5

Age-dependent attentional style and arousal regulate the reportability of spontaneous mental states

Matthieu Koroma [1,2], Aurèle Robert de Beauchamp [1], Sepehr Mortaheb [1,2], Paradeisios Alexandros Boulakis [1,2], Christine Bastin [1,2,3,4], Athena Demertzi [1,2,3,4]

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Spontaneous thinking significantly relies on attention and arousal. As these cognitive faculties change with age, we aimed at providing a comprehensive account to ongoing mental states in seniors, testing how these are influenced by attentional control and arousal. Using experience sampling at rest, 20 senior (65-75yrs) and 20 young participants (20-30yrs) were prompted to report mind-wandering (MW), sensory-related thoughts (S), and the newly introduced state of mind blanking (MB). Attentional control was assessed with the Attentional Style Questionnaire, and arousal with continuous monitoring of pupil diameter. Both age groups showed equally high occurrences of MW compared to MB or S. For young responders, we replicated previous findings that MW was more prevalent in easily-distracted participants and was associated higher arousal (pupil dilation). For seniors, such pattern was reversed, since more easily-distracted participants presented decreased rates of MW that were associated with lower arousal (pupil restriction). Overall, our results show that attentional control and arousal jointly regulate ongoing mental states in an age-dependent manner. We additionally found that more easily-distracted seniors present subjective and objective markers of spontaneous thinking that diverge from both young adults and more focused seniors. This uncovers the presence of a specific profile of ongoing mental state regulation in healthy aging, being a potentially critical marker of age-associated diseases. All data can be accessed on the OSF page of the project https://osf.io/mknjr/. All codes for analyses can be found on https://gitlab.uliege.be/S.Mortaheb/mb_aging.git. The preprint is available at https://www.biorxiv.org/content/10.1101/2022.07.08.499379v2

Clinical populations - Poster 1

Characterising cortical markers of cognitive control in Parkinson's disease with mobile EEG when walking and stepping over obstacles

Magda Mustile [1,2], Dimitrios Kourtis[2], Martin G Edwards[1], Simon Ladouce[3], Daniele Volpe[4], Manuela Pilleri4, Elisa Pelosin[5], Gemma Learmonth[6,1], David Donaldson[7], Magdalena Ietswaart[2]

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The loss of the ability to conClinical populations -Clinical populations -Clinical populations -trol gait represents one of the main risk factors for falling and hospitalisation in elderly and in patients with neurological disorders, such as Parkinson's disease. Gait impairments are particularly frequent in Parkinson's disease patients who exhibit reduced gait speed, shorter stride length and poor postural control. These disturbances result in unstable gait control, making daily life activities very challenging and risky, such as when they have to overcome obstacles. Despite the extensive literature on gait problems in Parkinson's disease, to date, cortical markers of cognitive and motor control during walking in Parkinson's disease have been investigated only through tasks with relatively low ecological validity. To better understand cognitive and neural processes underlying gait control, it is necessary to target natural movements in circumstances that resemble real life scenarios. In the present talk, I will present an investigation of the neural correlates of naturalistic obstacle avoidance in Parkinson's disease using the mobile EEG. We examined 14 patients with Parkinson's disease and 17 neurotypical control participants. Brain activity was recorded while participants walked freely, and while they walked and adjusted their gait to step over expected or unexpected obstacles displayed as images on the floor. The EEG analysis revealed attenuated cortical activity in Parkinson's

patients, in both theta (4-7 Hz) and beta (13-35 Hz) frequency bands, before and after an obstacle avoidance. This reduced cortical activity suggests a deficit of motor-cognitive control in Parkinson's disease involving impairments in the proactive and reactive strategies used to avoid obstacles while walking.

Clinical populations - Poster 2

Towards the automated detection of interictal epileptiform discharges with MEG

Raquel Fernández-Martín, Odile Feys, Elodie Juvené, Alec Aeby, Charline Urbain, Xavier De Tiège, Vincent Wens

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The analysis of clinical magnetoencephalography (MEG) in patients with epilepsy traditionally relies on visual identification of interictal epileptiform discharges (IEDs), which is time consuming and dependent on subjective criteria. Here, we explore the ability of Independent Components Analysis (ICA) and Hidden Markov Modeling (HMM) to automatically detect and localize IEDs. We tested our pipelines on resting-state MEG recordings from 10 school-aged children with (multi)focal epilepsy and we compared results with visual IED detection by an experienced clinical magnetoencephalographer. We get that for focal epilepsy patients, both pipelines successfully detected visually identified IEDs, but also revealed unidentified low-amplitude IEDs. Success was more mitigated in patients with multifocal epilepsy, as our automated pipeline missed IED activity associated with some foci—an issue that could be alleviated by post-hoc manual selection of epileptiform ICs or HMM states. We conclude that IED detection based on ICA or HMM represents an efficient way to identify IED localization and timing, with heightened sensitivity compared to visual inspection and requiring minimal input from clinical practitioners. The development of these automatic IED detection algorithms provide a step forward in clinical MEG practice by decreasing the duration of MEG analysis and enhancing its sensitivity.

Clinical populations - Poster 3

Evolution of semantic interference and facilitation in lexical retrieval in healthy aging

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Speech production requires the activation of semantic representations and the selection of a specific word among semantically related words in a mental lexicon. The literature has mainly explored the impact of semantic interference on lexical retrieval, but the potential beneficial effect of semantic context on this retrieval remains to be explored (Python et al., 2018). Interference is frequently caused by unrelated concepts (e.g. cow-computer). Nevertheless, even when concepts are interconnected, we can observe divergent effects. Indeed, an interference effect would be more marked when the relation between concepts is categorical (e.g. cow-horse), whereas an associative relation (e.g. cow-milk) would facilitate lexical retrieval. The aim of our study is to explore how semantic links can facilitate or interfere with lexical retrieval, while examining how these effects evolve with age. Aging can lead to cognitive difficulties such as a general slowing down and inhibition deficits, more specifically in interference resistance. Two groups will be formed: (1) 30 participants aged 18 to 25 and (2) 30 participants aged over 65. Our experimental protocol will include four conditions relating to the link between the image to be named and the word written over it: (1) a categorical condition (image and word belonging to the same category), (2) an associative condition (image and word sharing a temporality, spatiality, causality or functionality), (3) an unrelated condition (image and word are not semantically linked) and (4) a control condition (image and neutral symbol). The protocol is currently being pre-tested and we will present the preliminary results.

Clinical populations - Poster 4

How are Irritability and Anhedonia Symptoms Linked? A Network Approach

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Background: Anhedonia and irritability are two prevalent symptoms of major depressive disorder (MDD) that predict greater depression severity and poor outcomes, including suicidality. Although both symptoms have been proposed to result from paradoxical reward processing dysfunctions, the interactions between these symptoms remain unclear. Anhedonia is a multifaceted symptom reflecting impairments in multiple dimensions of reward processing (i.e., pleasure, desire, motivation, and effort) that may differentially interact with irritability. This study investigated the complex associations between anhedonia and irritability using network analysis. Method: Participants (N = 448, Mage = 33.29, SD = 14.58) reported their symptoms of irritability on the Brief Irritability Test (Holtzman et al., 2014) and anhedonia (including the pleasure, desire, motivation, and effort dimensions across four reward domains) on the Dimensional Anhedonia Rating Scale (Rizvi et al., 2015). A regularized Gaussian Graphical Model was built to estimate the network structure between items. Results: Irritability was negatively related to willingness to expand effort to obtain rewards in the social activities (estimate = -.13), food/drinks (-.09), and hobbies (-.07) domains, and consummatory pleasure in the hobbies (-.06) domain. Irritability was positively associated with a desire for food/drinks (.09). Limitations: Only a small proportion (5.8%) of our sample was clinical and the study design was cross-sectional. Conclusion: A specific link between irritability and the effort facet of the hedonic response across three reward domains was identified. Investigating effort expenditure deficits with experimental paradigms may help us understand the mechanisms underlying the comorbidity between irritability and anhedonia in the context of MDD.

Clinical populations - Poster 5

Category Learning, Discrimination, and Generalization of Shapes in Adults with and without Autism

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Individuals with Autism Spectrum Condition (ASC) are suggested to experience difficulties with categorization, which may fit with accounts of enhanced ability to discriminate and reduced ability to generalize in ASC. However, studies empirically investigating categorization, discrimination, and generalization in ASC have mainly focused on one process at a time, and typically used either behavioral or neural measures. Here, we investigated these three perceptual processes in combination in adults with and without ASC, both at a behavioral and neural level. By presenting shapes sampled from an artificial multidimensional stimulus space, we could investigate whether participants can (1) be trained to categorize instances of this space, (2) discriminate between different instances of the space before and after training, and (3) generalize trained categorization to an extended version of the stimulus space and a new stimulus space. In addition, by using frequency-tagging during electroencephalography measures, we added a direct, non-task related neural index to standard behavioral tasks. The study was completed by 38 adults with ASC and 38 neurotypical (NT) individuals. Our findings show that both individuals with and without ASC are able to categorize highly similar stimuli and to generalize this categorization after training. Moreover, in the initial stages of training and generalization to a different stimulus space, individuals with ASC are more uncertain and less precise. Finally, category learning significantly enhanced the sensitivity of categorical perception in participants with ASC compared to NT participants. This multi-level approach sheds new light on the mechanisms that underlie information processing issues in ASC.

Clinical populations - Poster 6

Examining cognitive differences in expert meditators and meditation-naive older adults

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Objectives. With aging, slight changes in some cognitive processes can be observed. Therefore, we aimed to assess if meditation expertise is associated with preserved cognition in key domains affected in ageing. Methods. We used data from two older-adult samples of the Medit-Ageing Age-well Study: 135 non-meditators and 27 expert meditators. We examined group differences in four objective cognitive domains (attention, executive functioning, episodic memory, and global cognition) and three subjective scores: Cognitive Difficulties Scale (CDS) total score as well as Attentional Style Questionnaire (ASQ) internal and external scores using generalized mixed effect models, controlling for age, sex, and education. Results. We did not observe group differences on attentional, executive and global cognitive scores or on ASQ internal score and CDS total score. However, meditators reported less external distraction (ASQ external score) and had better memory than non-meditators. Conclusion. These cross-sectional results indicate a better management of external stimuli and higher memory performance in expert meditators. Memory difficulties and distractions being the main complaints of older people, prolonged meditation practice could lead them to greater cognitive capacities important for healthy ageing.

Clinical populations - Poster 7

The Effects of Cognitive Load on Post-Stroke Mental Fatigue: Preliminary Results

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Background. Mental fatigue is a common post-stroke symptom, characterized by a feeling of exhaustion after prolonged mental effort. However, its impact on cognition remains unclear. Methods. Twenty stroke patients and 12 healthy controls underwent a mental fatigue induction task with varying levels of cognitive load (low and high). Cognitive load was manipulated by adjusting task duration and stimulus presentation time. High cognitive load (HCL) condition was associated to extended task duration and reduced stimulus presentation time, by comparison with low cognitive load (LCL) condition. Participants rated their subjective fatigue levels pre- and post-task using a visual analog scale and their propensity to rest in daily life through the BFS questionnaire. Two repeated measures ANOVA tests were conducted to determine group, time, and cognitive load effects on mean task accuracy and subjective fatigue levels. Group differences in rest propensity (BFS scores) were examined using a Student's t-test. Results. During the task, participants experienced higher fatigue ($p<.001$) and committed more errors ($p<.05$) in the HCL compared to the LCL condition. However, no group, time or interaction effects were observed. In general, stroke patients reported a greater need for rest following intellectual activities compared to healthy controls ($p<.05$). Discussion. Our study did not show a higher cognitive impact of mental fatigue in stroke patients than in healthy individuals. Interestingly, this finding contradicts the observed tendency among stroke patients to rest after daily mental activities. Further neuroimaging investigations may reveal underlying differences in brain function and activity, offering insights into our study's outcomes.

Clinical populations - Poster 8

Investigating the reactive-proactive control balance in older adults with MCI compared to healthy controls: an EEG study

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In this aging society, one of the biggest challenges is the increasing cognitive decline with older age. One cognitive function that declines with age and is necessary to achieve our goals in daily life is cognitive control. The Dual Mechanisms of Control theory (Braver, 2012) distinguishes proactive and reactive control. Whereas proactive control works preventively and anticipatory before conflict occurs, reactive control detects and resolves conflict only after it occurs. While young adults can flexibly switch between reactive and proactive control, this balance is disturbed in healthy older adults, where a shift takes place from a mainly proactive to a mainly reactive control pattern. However, little is known about this reactive-proactive control balance in clinical aging. Scarce studies suggest that clinical older populations are at an even increased risk of proactive control impairment, but also declines in reactive control. In this study, we will assess the reactive-proactive control balance in 40 Mild Cognitive Impairment patients, a clinical population reporting early-stage cognitive decline, and 40 healthy controls. We will administer a test battery assessing proactive and reactive control while simultaneously measuring EEG. This design will allow us to assess the reactive-proactive control balance in this clinical condition as compared to healthy aging. Furthermore, it will expose whether ERP components related to reactive and proactive control can be used as objective markers for early onset cognitive decline and, consequently, as early markers for dementia. This may inspire intervention programs aimed at this early cognitive decline population at risk of developing dementia.

Clinical populations - Poster 9

Enhanced sensitivity to the distributional history of words in congenital blindness

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Whether visual experience may affect the sensitivity to semantic distributional cues from natural language is an open issue that ignites a fervent debate. Here, we aimed to address this issue by conducting an independent reanalysis of data from Bottini et al. (2022), in which early blind and sighted participants performed an auditory lexical decision task. Since previous research has shown that semantic neighborhood density – the mean distance between a target word and its closest semantic neighbors – can influence performance in lexical decision tasks, we investigated whether vision may alter the reliance on this semantic index. We demonstrate that early blind participants were more sensitive to semantic neighborhood density than sighted participants, as indicated by the significantly faster response times for words with higher levels of semantic neighborhood density displayed by the blind. These findings suggest that an early lack of visual experience may lead to enhanced sensitivity to the distribution of words in natural language, deepening in turn our understanding of the strict interplay between linguistic and perceptual experiences in the organization of conceptual knowledge.

Clinical populations - Poster 10

Altered rs-fMRI Topological Properties in Late-Life Depression

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Late-Life Depression (LLD) refers to the major depressive disorder occurring in older populations. Previous studies have reported network (topological) changes in LLD patients while often focusing on global network changes with binary networks excluding the cerebellum regions. Moreover, associations between rs-fMRI activities and synaptic density (SD) have been found in healthy young adults and depressive symptoms. However, it remains unclear if the relationships between rs-fMRI network changes and SD exist in LLD patients. The study aims to investigate rs-fMRI network changes with weighted networks including the cerebellum at both global and nodal levels. Furthermore, we explore the relationships among rs-fMRI network changes, SD, and depressive symptoms. Apply graph theory approach to rs-fMRI data from 33 healthy older adults and 18 LLD patients, we calculated 4 global and 6 nodal topological properties across 7 threshold levels from 10% to 40% with steps of 5%. LLD patients exhibited altered nodal network changes in mPFC, left SFG, left STG, left MTG, basal ganglia, and two cerebellar regions while preserving intact global topological organization. Notably, robust negative correlations between betweenness centrality (BC, an index of hub identification) were observed across all threshold levels, as well as positive correlations between SD and BC in the vermis were found across 3 threshold levels. Our result underscores the pivotal role of the mPFC and the possible involvement of the cerebellum in LLD patients and suggests the sensitivity of SD in detecting network hub changes in rs-fMRI networks.

Clinical populations - Poster 11

Decision Trees as promising tools to investigate links between factors leading to fatigue build-up

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Fatigue is a complex and multifaceted phenomenon. It is commonly assumed that mental fatigue corresponds to a lack of mental energy and can be dissociated from physical fatigue which refers to the exhaustion of the body. Since the COVID-19 pandemic, research have shown an increase in prevalence of both types of fatigue symptoms, even in healthy individuals. While investigating fatigue in this context can be seen as a natural lab – with the advantage of being valid and ecologic – it is however not clear which factors could underlie this increase. An interesting method to predict a variable of interest considering several predictors can be found in decision trees algorithms. Here, we applied a decision trees analysis followed by a more robust random forest algorithm on a large dataset aiming to investigate the evolution of fatigue symptoms during the Belgium lockdown in April-May 2020. A cohort of 554 participants reported their degree of fatigue symptoms both before and during the lockdown as well as daily life and work characteristics and psychological aspects such as affective state and sleep metrics. With this approach, we want to demonstrate that algorithmic methods are promising tools to explore links between variables that could play a role the development of fatigue symptoms. Moreover, it allows a visual highlight of the links between predictors. This is done by the mean of easily interpretable decision trees graphs. More importantly, based on these exploratory analysis, one can further elaborate new hypothesis which take into account the relationship between predictors.

Memory, language & cognition - Poster 12

Nonarbitrary processes in language: evidence from pseudowords processing

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Nonarbitrary phenomena in language, such as systematic associations in the form–meaning interface, have been widely reported in the literature. Exploiting such systematic associations previous studies have demonstrated that pseudowords can be indicative of meaning. However, whether semantic activation from words and pseudowords is supported by the very same processes, activating a common semantic memory system, is currently not known. Here, we take advantage of recent progresses from computational linguistics models allowing to induce meaning representations for out-of-vocabulary strings of letters via domain-general associative-learning mechanisms applied to natural language. We combined these models with data from priming tasks, in which participants are shown two strings of letters presented sequentially one after the other and are then asked to indicate if the latter is a word or a pseudoword; and with data from an explicit two-alternative forced choice paradigm. Across different experiments, we show that word-pseudoword semantic relationship affects human behavior both at the implicit and explicit levels. These findings indicate that the same associative mechanisms governing word meaning also subserve the processing of pseudowords, suggesting in turn that human semantic memory can be conceived as a distributional system that builds upon a general-purpose capacity of extracting knowledge from complex statistical patterns.

Memory, language & cognition - Poster 13

Cultural Differences in Breakdown of Social Cognition in bvFTD: Chinese vs Flemish Consistencies and Specificities

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Early diagnosis of the behavioral variant of frontotemporal dementia (bvFTD) is currently a clinical challenge. Exhibition of neuropsychiatric deficits are often confused with symptoms from other psychiatric disorders, leading to frequent misdiagnosis. Some of the core behavioral symptoms of bvFTD are related to social interaction, highlighting the importance to study social cognitive decline as an early marker for this disorder. However, cultural difference in the social cognition of bvFTD patients still lacks sufficient investigation. Addressing this gap in the literature, our research aims to examine the similarities and differences in the early social cognitive deficits among bvFTD patients from two distinct cultures: Belgium and China. This is a joint project between KU Leuven and Peking University (China) with a three parts design. First, we intend to cross-culturally map and compare early behavioral symptoms within different life domains of bvFTD patients using semi-structured interviews involving caregivers of bvFTD patients. The interviews will be conducted in Belgium and China between 2023 and 2024. After obtaining a diverse range of phenotypes across different life domains, our next step involves examining their frequency and severity through a questionnaire with a bigger cohort of caregivers across both research sites. Finally, we will further examine the underlying neural correlates of the findings through MRI scans from bvFTD patients. Through this project, we strive to enhance our understanding of the cultural variations in early bvFTD phenotypes. The outcome of this project has the potential to improve current diagnostic tools for bvFTD.

Memory, language & cognition - Poster 14

Treatment of anomia in early stage Alzheimer's disease: Investigating the efficacy of Elaborated Semantic Feature Analysis using a single-case experimental design

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Anomia occurs early in Alzheimer's disease (AD) and has a significant impact on daily life. This study aimed to investigate Elaborated Semantic Feature Analysis (ESFA) method on anomia. Grounded in network models of semantic memory, ESFA seeks to enhance lexical retrieval by activating and strengthening semantic concepts. Six patients with early-stage AD were recruited (MMSE>20). The experimental design employed a single case experimental approach with the following phases. A baseline phase lasting three weeks which included naming task and a semantic matching task administered three times to establish a pre-therapeutic baseline. This was followed by an intervention phase lasting eight weeks involving two 50-minutes sessions per week. During treatment sessions, concepts failed in the naming task were selected for each participant and a semantic feature analysis chart was completed to activate the properties of the concepts. Two follow-up phases spanned four weeks: the naming and semantic matching tasks were administered once directly after the end of the treatment and once four weeks after the treatment phase. In addition, neuropsychological assessment was carried out during the baseline and follow-up phases. Executive functions, episodic memory, lexical-semantic and speech abilities were assessed. Anxio-depressive affect and quality of life were also assessed. The preliminary results showed small effect sizes for six participants. Moreover, a comparison of baseline and intervention trends (using non-overlapping data statistics) indicated a significant therapeutic effect (p-value < 0.05). Therefore, there was a progressive improvement in naming performances. In conclusion, ESFA was effective in improving participants' naming abilities.

Memory, language & cognition - Poster 15

The sensitivity of SSVEPs to variations in numerical material for automatic processing of small magnitude

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We investigated the human ability to automatically process small magnitude information, using an oddball fast-periodic visual stimulation paradigm featuring a periodic alteration of magnitude (2 vs. 4) at a frequency of 1.25 Hz. Participants were exposed to various types of numerical content, such as biological (fingers), analogical (dots), and symbolic (Arabic digits), presented either in their conventional format (canonical) or in alternative formats (non-canonical), all synchronized at a base rate of 6.25 Hz. Our primary objective was to ascertain the sensitivity of steady-state visual evoked potentials (SSVEPs) to subtle small magnitude variations in relation to the specific type of numerical material. SSVEPs were consistently observed at the base rate, corresponding to the presentation of the visual stimuli. Variations across conditions in terms of their location is examined, as well as the amplitude of the SSVEPs which is influenced by the type of material presented. Additionally, oddball SSVEPs emerged at a frequency of 1.25 Hz (and its harmonics) for each numerical content, suggesting the ability to discriminating the change of magnitude in each instance. However, the neural response exhibited distinctive characteristics based on the type of material presented. These findings demonstrate that SSVEPs, while maintaining consistency in their presence across conditions, exhibit a sensitivity to variations in the type of numerical material, shedding light on the neural processes involved in the automatic processing of small magnitude information.

Memory, language & cognition - Poster 16

The hippocampus contributes to both recall and familiarity memory thourgh scene representation

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In a recent fMRI study, we reported that the hippocampus and perirhinal cortex were preferentially activated for scenes and objects processing, respectively, across recall, familiarity, new judgments, and visual discrimination (Gardette et al., 2022). These results support a representation-based functional organisation of the medial temporal lobe, as opposed to a process-based view (Cowell et al., 2019). Recent evidence revealed that the cortical connectivity of the hippocampus differs both along its anterior-posterior (long) and medial-lateral (transverse) axes (Dalton et al., 2022). Specifically, the anterior medial region of the hippocampus (amHC) has been shown to represent spatial scenes in memory, imagination, and visual perception (Hodgetts et al., 2017; Zeidman & Maguire, 2016). In this context, we hypothesised that this region had driven the hippocampus activity we found across memory and non-memory operations in our original study. We therefore re-analysed the fMRI data from this study using a conjunction analysis, which tests whether a set of brain regions were significantly activated in several tasks (Friston et al., 2005). We found that the [scene > object] contrast in recall, familiarity, new judgements, and visual discrimination, engaged medial temporal, occipital, and parietal regions that correspond to the well-established scene construction network. Additionally, the amHC region was consistently activated in all tasks for scene processing. These results support the idea that the amHC represents spatial scenes irrespective of the cognitive process engaged, and that through this mechanism, the hippocampus contributes to both recall and familiarity memory.

Memory, language & cognition - Poster 17

Does deciding whether a primed picture is natural or manufactured really activate semantic memory? Comparing the temporal dynamics of taxonomic and thematic priming using ERP

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Introduction : Semantic knowledge involves two systems: taxonomic links (e.g., tiger – lion) encompass concepts with similar features, while thematic links (e.g., cow-milk) involve concepts occurring within the same event. Prior studies demonstrated easier processing of thematic links than taxonomic associations. Method : In an exploratory approach, an event-related potentials (ERP) study was conducted to investigate how visual and associative cortices contribute to determine if a target picture is natural or manufactured when taxonomically or thematically primed. The research aimed to understand whether visual or semantic processing is activated during visual taxonomic or thematic priming processing. For this purpose, 26 healthy adults (Mage = 26.57 ; SD = 7.21) had to classify targets as natural or artificial entities, the priming stimuli being thematically or taxonomically related. Both primes and targets were pictures. Results : No significant difference appeared between thematic and taxonomic conditions on the ERP signals. However, at a behavioral level, participants processed taxonomic links faster than thematic links ($p < .001$). Discussion : In contrast with literature, taxonomic links were processed faster than thematic links. As the stimuli in the paradigm were pictures, target categorization involves early visual processing, evident from a peak in the EEG signal during the priming process. From a visual processing point of view, not a semantic one, priming helps to retrieve target features, which are more important at the taxonomic level (e.g., apple – pear) than at thematic level (e.g., apple – pie). This suggests easier retrieval of taxonomic links, specifically for this type of task.

Memory, language & cognition - Poster 18

The effect of Cued-Speech perception on speech understanding and on the listening effort to understand speech

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Cued speech (CS) is a visual communication system designed to disambiguate lipreading through the use of manual gestures. Unlike other co-speech gestural systems, CS acts at the phonological level of the language facilitating oral speech comprehension for individuals with hearing impairment. Previous research provided compelling evidence that familiarity with CS offers an advantage to hearing-impaired individuals in challenging listening conditions. Combining manual gestures to lipreading yielded an improvement of 28% of correct word-in-sentence identification relative to lipreading condition. However, a lingering question remains regarding the cognitive costs underlying the gain on speech intelligibility. To address this question, we combined an audio-visual sentence recall task with pupillometry.Our study included nineteen adults with severe-to-profound hearing loss, consisting of 13 cochlear implant users and 6 hearing aid users, all proficient in CS. Participants were instructed to repeat sentences presented in both the audio+lips and audio+lips+CS gesture conditions. The percentage of correct keyword identification was scored for both conditions. As a neurophysiological measure for cognitive effort, task-evoked pupillary response was computed by the extraction of mean pupil dilation during sentence presentation. We compared mean pupil size dilation and the score of correct responses in audio-lips condition and in audio+lips+CS gesture conditions. The mean score of correct responses was significantly Improved when CS gestures were added. In addition, adding gestures elicited a decrease in pupil dilation relative to audio+lips condition. With these findings we provide evidence that CS perception not only enhances speech understanding but also decreases cognitive effort for individuals with hearing impairment.

Memory, language & cognition - Poster 19

The visual word form area engages in processing Braille visually in expert readers

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The visual word form area (VWFA) is a region of the ventral occipito-temporal cortex (vOTC) that responds preferentially to orthographic material. One prominent account suggests that VWFA's preference builds on the intrinsic selectivity for low-level features shared among most orthographic systems, like specific line junctions (e.g. T, L, Y). Alternatively, the VWFA could be sensitive to any alphabetic material, irrespective of these specific low-level features. We present evidence showing that VWFA in processing visual Braille in expert readers, a script developed for touch that does not share some low-level characteristic of classical alphabets like line junctions. First, we functionally localized VWFA contrasting orthographic material with control visual stimuli. In expert visual Braille readers, but not in people naïve to visual Braille, VWFA also showed preferential activity for Braille over scrambled Braille stimuli. In a second experiment, we show that some linguistic properties of words can be decoded from classical orthographic material in both groups while those linguistic properties can be decoded in Braille only in experts. Importantly, cross-script decoding failed to reveal common representations across French and Braille orthography. These results indicate that linguistic information, rather than typical visual features of scripts, seems to play an important role in determining the response of this word-selective brain area. However, different scripts seem to be processed differently by VWFA, supporting a multifaceted account of VWFA selectivity.

Memory, language & cognition - Poster 20

Resonance breathing can improve cardiac interoception through the modulation of cardiovascular mechanisms

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Background: Interoception, the ability to perceive internal bodily sensations, and heart rate variability (HRV) share common physiological pathways, including the baroreflex feedback loop. Resonance breathing (6 times per minute, 0.1Hz) activates the baroreflex, eliciting immediate physiological changes and longer-term therapeutic responses. This registered report examined individual differences in cardiac functioning driving interoceptive capacity, and whether the cardiovascular changes elicited by resonance breathing could improve interoceptive capacity. Method: Participants completed a two-session study (n=67). Cardiac Interoceptive awareness was measured using the heartbeat discrimination task at baseline and after a resonance breathing task. A control breathing task was also implemented. Baroreflex sensitivity and HRV data was obtained at baseline and during breathing periods. Results: At baseline, we found a negative relationship of interoceptive accuracy with HF HRV and BRS. During resonance breathing we found that increases in 0.1Hz HRV and BRS positively correlated with increases in interoceptive accuracy. Discussion: Our results show that reduced variability in cardiac signalling facilitates the perception of individual heartbeats, and that interoceptive capacity is further increased when breathing recruits the resonant properties of the cardiovascular system. We posit that more stable HRV reduces interoceptive prediction errors, facilitating the conscious perception of interoceptive signals. Further, during resonance breathing cardiac oscillations are maximally aligned in a predictable oscillatory pattern at 0.1Hz. The predictability of these cardiac oscillations would further improve interoceptive capacity via predictive processing. These findings can open new interpretations for the role of resonance breathing on mental health from an interoceptive inference perspective.

Memory, language & cognition - Poster 21

Systematic Review: Electrophysiological Markers of Language in Neurodegenerative Diseases

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This systematic review aims to evaluate the diagnostic utility of electroencephalography (EEG) in Alzheimer's disease (AD), Frontotemporal Dementia (FTD) including Primary Progressive Aphasia (PPA), and Lewy Body Dementia (LBD). Considering the range of language deficits within these populations, we opted to highlight linguistic event-related (ERP) markers.
The review was preregistered with PROSPERO (ID: CRD42023392253). We searched databases for articles from 2000 to 2023, yielding a total of 12010 studies. Selecting only linguistic ERP-markers, 12 studies were included.
Our findings highlight alterations in the N400 component, elicited by a semantically unexpected stimulus, as the most prominent ERP-marker. In AD, the N400 amplitude was consistently reduced in seven out of eight studies. One genetic study of AD, suggested that topographic disruptions in N400 generators precede symptoms. Similarly, PPA patients exhibited significant alterations in the N400 compared to healthy controls, with hardly detectable N400 responses in semantic PPA (svPPA), delayed responses in logopenic (lvPPA), and mixed results in nonfluent PPA (nfvPPA). Additionally, some studies argue that combining the N400 and the P600, enhance diagnostic accuracy in mild AD and in discriminating nfvPPA from lvPPA. In conclusion, our review supports the diagnostic and potential differential diagnostic value of electrophysiological markers, and in particular the N400. Nonetheless, alterations in this component were not limited to PPA and AD, but were also observed in healthy ageing. Standardization of used paradigms and modalities, as well as inclusion of larger study populations and controls of various ages, could increase the value of reported results.

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Task-independent neural bases of peer presence effect on cognition in children and adults

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All behaviors can be changed by the mere presence of an observer, positively (social facilitation) or negatively (social inhibition), Yet, the neural mechanisms orchestrating such ubiquity remain poorly understood. Even less is known about when they emerge during childhood. To address these issues, fMRI data were collected in children (age: 10-13) and adults alternately observed and unobserved by a familiar peer while they compared either the number of dots in two arrays or the sounds of two written words, i.e., engaged basic skills foundational to math and reading, respectively. Consistently with earlier behavioral findings, peer observation facilitated both tasks, and children's improvement was comparable to adults'. Contrary to our expectations, no main observation-driven change was found within the task-specific neural substrates of numerosity and phonological comparisons. Rather, whole-brain analyses revealed a unique neural signature of observation for both tasks, largely shared by children and adults. This task-independent signature encompassed widespread changes in several brain networks known for their domain-general involvement in social cognition (especially mentalizing), attention, and reward. Children's pattern of observation-driven neural changes largely resembled adults', with the exception of the attention network, and particularly the anterior right TPJ. Only in adults did this area show a lesser deactivation in observed relative to unobserved trials. These findings indicate that social facilitation of some human education-related skills i) is primarily orchestrated by domain-general brain networks, rather than by task-selective substrates, and ii) matures relatively early in the course of education, thus having a protracted impact on academic achievements.

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Working Memory Training and Transcranial Direct Current Stimulation in older adults: A resting-state EEG analysis

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Working Memory (WM) is a core cognitive function underlying many daily activities, yet it declines with age. Approaches to slow down age-related cognitive decline, such as transcranial direct current stimulation (tDCS) combined with cognitive training, show promise but their effect on brain activity is still poorly understood. Brain oscillations in the individual alpha and theta bands, as measured by electroencephalography (EEG), are believed to relate to inhibition and WM performance, respectively. While empirical evidence indicates a tDCS modulation of brain activity during a task in older adults, its impact on brain activity at rest remains unclear. Here we discuss the modulation of resting-state brain activity in older adults after five sessions of anodal tDCS stimulation over the right DLPFC. Forty participants (μage= 69.5) were double-blindly assigned to a sham and active stimulation group. Task-related and resting-state EEG was collected before and after five consecutive days of cognitive training combined with tDCS stimulation and at a follow-up after approximately one month. We hypothesized training-induced posterior alpha and medial-frontal theta band power changes to be modulated by tDCS. Preliminary results show that posterior alpha power was significantly modulated by the interaction of training sessions (pretest, posttest, and follow-up), brain state (eyes open or closed), and initial working memory capacity ($F=8.523$, $p < 0.001$, $\eta^2p= 0.205$). Follow-up analyses revealed that it was only individuals with low working memory capacity who showed a significant increase in alpha power in the eyes closed condition ($p= 0.006$), but no effects of stimulation or modulation of theta power. Further analysis will explore alpha and theta power modulation at the network level and the impact of power changes on training performance. These findings provide insights into the impact of combined tDCS and cognitive training on electrophysiological activity.

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The value of joint listening in creating attunement between babies, toddlers and kindergarten teachers

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Developmental neuroscientists have repeatedly demonstrated and confirmed that listening is the portal to trigger the entire social engagement system and that certain types of music and voice do trigger a sense of safety. Optimal development of the baby's and toddler's brain is only possible in an attuned and safe relationship with the available and attuned caregiver. The goal of the research, conducted as part of the B-AIR international project in cooperation with Radio Slovenia, was to enable teachers to include joint listening of radio plays as a part of their daily kindergarten routine and make it more inspiring and pleasant for children. Carefully created musical radio plays for babies and toddlers were chosen and sent to 34 kindergarten groups of children (aged 1 to 3 years and 4 to 5 years). We explored which radiophonic elements invoke safety and calms the babies and toddlers and which were the key for invoking interest, emotional response, and attention in children. With the results of qualitative research, obtained by triangulation of data (observation, analysis of children's drawings, teacher's feedback), we found that the dynamics, rhythm, and dialogic nature of the fairy tale are vital to maintaining the child's attention, whereas broadly interwoven radiophonic elements effect a deeper sensory experience. Listening to radiophonic works is quite challenging for children, so a safe and properly prepared environment and the presence of an adult is advised. Through this experience teachers found out that listening helps them connect with children and enables better regulation of the group.

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Investigating stress physiology, self-regulation and co-regulation among prematurely born toddlers and their mothers

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While prematurely born infants generally show increasing survival chances in high-income countries, they remain at risk of poor (mental) health outcomes and neurodevelopmental disorders, such as cognitive and affective difficulties, ADHD, autism, etc., jointly referred to as the "preterm behavioural phenotype". This long-term maladaptive outcome may partly be due to the higher levels of stress and pain (e.g. skin breaking procedures) that they experienced during the vulnerable neonatal period. This may further impact the caregiver-child attachment process, which lays the foundation of future social functioning and general development. Building on the pioneering biobehavioural synchrony framework, we aim to study the development of stress regulation within its social context. We will focus on a cohort of prematurely born preschool children and their mothers. This cohort has been recruited at birth and studied until the age of 2 years, yielding a unique longitudinal database of medical, physiological, psychological and endocrinological parameters of both child and parents. At the age of five, biobehavioural synchrony (dual EEG, stress physiology, eye-tracking, mimicry and behaviour) will be assessed across multiple contexts and multiple interaction constellations (including mother-child and experimenter-child synchrony). We will focus on stress physiology measurements such as heart rate (variability), skin conductance and pupillometry. We will examine the individual arousal signals of the child and the mother, their co-fluctuation over time (i.e., synchrony), the extent to which this synchrony is determined by individual arousal levels and the extent to which this physiological synchrony relates to the quality of the behavioural and socio-affective relationship.

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Circadian rhythm of body temperature and aging effects on visuospatial working memory

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Circadian rhythms (CR) play a role in human cognition and are associated with age-related amplitude reduction and phase advance. We examined the influence of CR and aging on visuospatial working memory (vsWM) in both young (n=20, aged 18-35) and older (n=16, over 65) individuals. CR was assessed by monitoring the 24-hour variation in distal-proximal body temperature gradient (DPG) over 5 days using iButtons. vsWM was evaluated in the morning and evening on separate days using an object-location visuospatial binding task, allowing differentiation between identification and localization performance, varying with different levels of working memory load and retention delays. We hypothesised that vsWM performance is modulated by age and testing time-of-day and is further associated with 24-h DPG amplitude. Repeated measures ANOVAs indicated that DPG exhibits a circadian pattern ($F=17.998$, $p<.001$) and differs between age groups ($F=2.071$, $p<.001$). Harmonic regressions revealed a decreased amplitude in older participants compared to the young ($t=3.86$, $p<.001$), but no significant phase shift ($t=2.88$, $p=.08$). Using Aligned Rank Transform ANOVAs, we found that vsWM localization (binding) performance was lower in older individuals compared to the young ($F=348.102$, $p<0.001$), as well as identification accuracy ($F=86.134$, $p<.001$), with item load having a greater impact in the older group ($F=42.979$, $p<0.001$). However, neither testing time-of-day nor 24-hour DPG amplitude were associated with vsWM parameters (ps>0.1). In summary, our results confirm reduced CR amplitude and vsWM performance with aging, but we did not observe a connection between working memory and the time of testing or CR amplitude fluctuations.

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Neural evidence of diminished social tuning of prematurely born preschoolers towards voices but not faces

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The survival rate of very preterm infants (gestational age < 32 weeks) has steadily increased over the years. Unfortunately, this is not without long-term neurodevelopmental impact, such as a higher prevalence of socio-emotional and cognitive difficulties. Here, we monitor a well-phenotyped cohort of prematurely born children and their parents, from their early days as newborns at the Neonatal Intensive Care Unit (NICU). At five years of age, we administered a series of frequency-tagging EEG paradigms to investigate the neural sensitivity to crucial social cues, i.e. sensitivity for faces and voices. Frequency-tagging EEG is based on the principle that brain activity will synchronize with the frequency of periodic stimulation, thereby allowing to selectively tag different streams and categories of sensory stimulation. We applied two multi-input frequency-tagging EEG paradigms with streams of social and non-social stimuli presented simultaneously but each tagged at different presentation rates. In the visual domain, we presented streams of faces and houses. In the auditory domain, we presented streams of voices and object sounds. Preliminary results comparing preterm (N = 40) versus full-term (N = 18) preschoolers showed reduced social tuning in the auditory but not in the visual domain. The diminished tuning towards voices in the preterm population can be interpreted against the background of atypical auditory and premature visual stimulation in the NICU environment. This research can contribute to understanding the socio-emotional and communicative development of preterm children and may help identifying those children at risk of psychopathology or subclinical socio-emotional difficulties.

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Adolescent development of late auditory event-related potentials

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Late auditory event-related potentials (ERPs) have been used extensively to investigate the function of the auditory pathway in individuals with normal hearing and with hearing loss. They reflect successive levels of sound processing (e.g., detection, discrimination) across the auditory pathway. From birth to old age, late ERPs undergo a series of morphological and topographical changes across the lifespan. In fact, some studies suggest that late auditory ERPs maturation follows a step-like function with specific changes at the beginning and the end of adolescence. Interestingly, the beginning of adolescence is marked by puberty onset, which triggers a cascade of hormonal changes that might drive neural plasticity. Therefore, we hypothesize that pubertal changes associated with adolescence might drive the developmental changes in the morphology of late ERPs. To test this hypothesis, we will try to age- and gender-match the participants. We will present them with an EEG oddball-paradigm of audio(visual) speech stimuli, and we will record late auditory ERPs evoked by these stimuli. We expect a step-like development according to pubertal stages, as opposed to one according to age. This will, for example be reflected in the responses of the early-pubertal adolescents being more adult-like than those recorded in pre-pubertal children. So far, we have recorded pilot results from five adult participants. We will be recording ERPs in a cohort of over 100 children/adolescents. At the conference, we will introduce our research question, present our hypothesis and methodological set-up, and preliminary results from children/adolescents.

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Context-dependent categorization of face-like visual stimuli in the infant brain

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Face pareidolia is the illusory perception of a face in face-like objects or patterns, as reflected by face-selective electroencephalographic (EEG) activity in both adults and infants. However, the perceptual interpretation of these face-like stimuli depends on the context in which they are presented. In particular, we recently found that, in adults, face-like stimuli are interpreted as faces in a non-face context and as non-face objects in a face context. Accordingly, here, we aim to explore how visual context shapes the perception of face-like stimuli early in life. We measured scalp EEG activity in 4-to-6 months-old infants using an interlaced frequency-tagging approach. Infants were exposed to 20-second sequences of natural images presented at a rate of 6 images per second (6 Hz), with face-like stimuli inserted every 5th image (at 1.2 Hz), and face or house images inserted every 4th image (at 1.5 Hz), defining a visual face or non-face context, respectively. Preliminary data (N=10 infants) reveal that the brain response to face-like stimuli is weaker in infants than in adults. Contrary to the adult responses, the infant response is also more face-like in the face context (with a typical temporo-parietal location of the response) and shifts to a more occipital response in the non-face context. While these preliminary results still need to be consolidated, they suggest that the influence of visual context on the categorization of face-like stimuli changes throughout development, likely due to the effectiveness of perception at a given developmental stage.

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Infants' visual statistical learning abilities benefit from early exposure to the environment

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Statistical learning (SL) abilities are of primary importance since they form the basis of children's abilities to organize and form coherent representations of the external world. How the constraints linked to cerebral maturation and to the infant's experience with their environment interact with SL mechanisms remains an open question. Using an infant-controlled habituation paradigm in which three doublets of shapes were presented randomly, we examined infants' ability to differentiate between sequences of shapes of high, low, and null transitional probability (TP), after habituation. We tested 8- and 10-month-old full-term infants, and very preterm infants at 8 months of adjusted age. Preterms were therefore paired on postmenstrual age with the youngest full-terms – that is, they share the level of cerebral maturation but have more ex-utero experience, and on chronological age with the oldest full-terms – that is, they share the amount of experience with the external world but have less mature brains. In both the habituation and test phases, we observed an association between global looking times and post-menstrual age. The attention devoted to visual stimuli would thus mostly depend on cerebral maturation. In the test phase, results revealed a typical developmental pattern: while 8-month-old full-terms showed a familiarity preference, 10-month-old full-terms showed a novelty effect. Critically, preterms likewise exhibited a novelty effect. These findings thus demonstrate that preterms benefit from their early exposure to regularities outside the womb, and support that, at that age, visual SL abilities depend more on experience than on cerebral maturation.

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Disentangling schooling and age effects on children's white matter networks of arithmetic and reading

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Children's white matter development is driven by experience, yet it remains poorly understood how it is shaped by the transition to formal schooling. A small number of studies compared children before and after the start of formal schooling to understand this, yet they do not allow to separate maturational effects from schooling-related effects. A clever way to (quasi-)experimentally address this issue is the longitudinal school cut-off design, which compares children who are similar in age but differ in schooling (because they are born right before or after the cut-off date for school entry). We used for the first time such a longitudinal school cut-off design to experimentally investigate the effect of schooling on children's white matter networks. We compared "young" first graders (schooling group, n = 34; Mage = 68 months; 20 girls) and "old" preschoolers (non-schooling group, n = 33; Mage = 66 months; 18 girls) that were similar in age but differed in the amount of formal instruction they received. Our study revealed that changes in FA and MD in five a priori selected white matter tracts during the transition from preschool to primary school were predominantly driven by age-related maturation. Moreover, we did not find specific schooling effects on white matter, despite their strong presence on early reading and early arithmetic skills. The present study was the first to disentangle effects of age-related maturation and schooling within a longitudinal cohort of 5-year-old preschoolers at the level of the white matter.

Perception, attention & awareness - Poster 32

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

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Recent theories claim that valence plays an important role in conscious perception (Cleeremans & Tallon-Baudry, 2022, Barrett & Bar, 2009). Inspired by this, we tested how valence judgments are related to similarity judgments and whether they correlate with stages of processing in deep neural networks (DNNs). Forty-seven participants provided similarity judgments for 120 images of everyday objects using the odd-one-out task. Using the birthday task (Lebrecht, 2012), we also collected affective judgments. For the same images, we extracted activations from the layers of DNNs trained to classify objects. Leveraging representational similarity analysis, we first compared perceptual and affective dissimilarities between stimuli. We found that affective processing was correlated with similarity processing, indicating that valence contributes to similarity judgments. DNN analysis showed that perceptual features contributed to both valence and similarity processing. Importantly, valence processing correlated with activations in the first DNN layers, indicating that low-level visual features take part in the computation of valence. These results indicate that valence computation may happen already in early visual processing. They also show that valence is involved in similarity judgments, suggesting a link between affect and cognition, corroborating claims for the functional role of affective conscious experience (Cleeremans & Tallon-Baudry, 2022).

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Prediction error as the Basis of the Testing Effect: Empirical and Modelling Evidence

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A robust finding in declarative memory is the testing effect: being tested leads to enhanced subsequent memory relative to mere studying. Despite the robustness and educational relevance of this effect, its origin remains unclear. Previous work demonstrated that prediction error is an important factor in declarative memory formation. Based on this work, we currently postulate that the testing effect may originate from prediction error, and specifically from reward prediction error (RPE). In a testing (rather than studying) situation, people develop confidence (reward prediction) in their answers, and the discrepancy between this confidence and the feedback (reward outcome) elicits an RPE. To investigate this hypothesis, we conducted two experiments where we systematically investigated the effects of RPE and testing (versus studying) on the recognition of word pairs. The behavioral results showed a robust testing effect, as well as an increased subsequent memory for word pairs coupled with positive RPEs. To further gain insights into the relevant cognitive processes, we developed and empirically compared several neural networks. Across the two studies, we found that adding RPE to these models was crucial to account for the data. In summary, our data and model jointly suggest that RPE is indeed a critical variable related to the testing effect.

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The effect of expectation violations on the subjective experiences of confidence and effort

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During the execution of a challenging task, we are exposed to task features which in turn shape our subjective experiences. Artificially changing the level of task difficulty elicits subjective experiences of both confidence (subjective probability of being correct) and effort (subjective feeling of investment). The relationship between manipulated task difficulty and subjective experiences has been found to be mostly linear. The more difficult the task, the less confident and the more effort you feel. However, the stability of this relationship is still under discussion. In our study, we manipulated participants' expectations about difficulty of the upcoming perceptual task. We then analyzed how the violation of those expectations (e.g., encountering a difficult trial when an easy one was promised) impacts the subjective experiences of both confidence and effort. Participants were shown a cue on the difficulty of the upcoming trial, and had to rate their predicted subjective experience. Then, they were shown a target, which could either align with the expected difficulty or differ, and rated their retrospective subjective experience. Results show that the violation of expectations had an impact on multiple subjective experiences, and across levels of objective difficulty. Participants based their retrospective rating on the difficulty of the cue, more than the actual target difficulty. Overall, participants showed a tendency to stick to their first initial evaluation and thus struggle to flexibly adapt their subjective experiences with new evidence. In conclusion, subjective experiences are sensitive to both objective difficulty but also to expectations about task difficulty.

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The nature of magnitude integration: contextual interference vs. active magnitude binding

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In the everyday life, time and numerosity often interact with each other to build a coherent representation of the environment. Many experiments investigated the nature of this interaction showing a mutual bias between these features. Nevertheless, there is a fundamental question that remain unanswered: is the magnitude integration phenomenon just a contextual effect, emerging as a sort of interference when two different types of information are available at the same time? Or does it represent an active integration (binding) of the different dimensions of the same object? Here we directly address these two possibilities, making duration and numerosity to either belong to the same visual stimulus, or to two separate stimuli. The results show that an attractive effect emerges only when duration and numerosity are conveyed by the same object. Conversely, when two different stimuli convey the information about duration and numerosity, we found a strong repulsive effect. In conclusion, our results show an active magnitude binding process going on during the features integration, and that having the two dimensions conveyed by the same stimulus is a necessary condition for a positive integration to occur. Instead, when this magnitude binding fails, the perception of one magnitude is pushed away from the other. Overall, these findings suggest that binding of magnitudes belonging to the same objects is a fundamental process for magnitude integration, and likely represents one of the core computations of the magnitude system occurring during visual processing.

Perception, attention & awareness - Poster 36

Featural blindsight in a 2-Interval Forced-Choice task

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The comparison between conscious and unconscious perception is a cornerstone of consciousness science. However, most studies reporting above-chance discrimination of unseen stimuli do not control for criterion biases when assessing awareness. We tested whether observers can identify subjectively invisible offsets of Vernier stimuli when visibility is probed using a bias-free task. To reduce visibility, stimuli were either backward masked or presented for very brief durations (1-3 milliseconds) using a modern-day Tachistoscope. We found some behavioral indicators of perception without awareness, and yet, no conclusive evidence thereof. To seek more decisive proof, we simulated a series of Bayesian observer models, including some that produce visibility judgements alongside type-1 judgements. Our data are best accounted for by observers with slightly suboptimal conscious access to sensory evidence. Overall, the stimuli and visibility manipulations employed here induced mild instances of blindsight-like behavior, making them attractive candidates for future investigation of this phenomenon.

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Partially Disrupted Ordered Structures Attract Attention in the Same Way As Completely Ordered Structures

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Interacting with the surrounding environment is vital for individuals' survival. In our material world, the arrangement of objects can be classified into two states: order and disorder, which coexist and intertwine with each other. Multiple experiments conducted in real-life settings have found that the order of objects in the environment subtly influences people's cognition, emotions, and behavior. It is crucial to conduct intricate experiments to gain deeper insights into how order influences cognitive mechanisms in individuals. Additionally, attention is pivotal in cognition. By studying attention, we can significantly enhance our understanding of cognitive mechanisms. Therefore, it's essential to investigate the impact of order on attention. In this study, we explored the effect of visual order on attentional bias by six experiments. Experiments 1a and 1b, utilizing the dot-probe paradigm, revealed a stronger attentional bias towards ordered stimuli compared to random stimuli. The results remained consistent across both horizontal and vertical orientations, despite the reaction time being shorter in the horizontal orientation than in the vertical orientation. Experiments 2a and 2b, employing the spatial cueing paradigm, further demonstrated that the key component of attentional bias towards ordered stimuli was facilitated attention. Moreover, Experiments 3a and 3b showed that attentional biases persisted when the overall structure was partially disrupted. In a word, the study demonstrates a pronounced attentional bias towards ordered stimuli in both horizontal and vertical orientations, and the key is facilitated attention. Furthermore, even when certain parts of the ordered structure are disrupted, they still evoke greater attentional bias.

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Lateralization of the cerebellum in mentalizing: a TMS study

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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 a mentalizing task 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). TMS over the right cerebellar hemisphere affected participants' performance compared to the vertex and the left cerebellar hemisphere. Our findings point to right lateralization of the cerebellum in mentalizing processes and offer new insights into functional brain asymmetry.
Keywords: cerebellum; mentalizing; transcranial magnetic stimulation; social cognition.

Perception, attention & awareness - Poster 39

Frequency-tagging EEG reveals the effect of attentional focus on abstract magnitude processing

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While humans can readily access the common magnitude of various codes such as digits, number words or dot sets, it remains unclear whether this process occurs automatically, or only when explicitly attending to magnitude information. We addressed this question by examining the neural distance effect, a robust marker of magnitude processing, with a frequency-tagging approach. Electrophysiological responses were recorded while participants viewed rapid sequences of a base numerosity presented at 6 Hz (e.g., “2”) in randomly mixed codes: digits, number words, canonical dot and finger configurations. A deviant numerosity either close (e.g., “3”) or distant (e.g., “8”) from the base was inserted every five items. Participants were instructed to focus their attention either on the magnitude number feature (from a previous study), the parity number feature, a non-numerical color feature or no specific feature. In the four attentional conditions, we found clear discrimination responses of the deviant numerosity despite its code variation. Critically, the distance effect (larger responses when base/deviant are distant than close) was present when participants were explicitly attending to magnitude and parity, but it faded with color and simple viewing instructions. Taken together, these results suggest automatic access to an abstract number representation, but highlight the role of selective attention in processing the underlying magnitude information. This study therefore provides insights into how attention can modulate the neural activity supporting abstract magnitude processing.

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Representation of complex emotional and social scenes in category-selective regions and deep neural networks

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Recognizing emotions expressed by others relies on multiple sources of information including facial and body expressions, and scene or social context. However, most studies have used stimuli like expressive human faces or natural scenes for which emotion recognition is not highly sophisticated, does not require fusion of multiple sources, or could even be derived through simple object recognition. Here, to examine the role of category-selective regions in emotion recognition, we prepared a novel set of complex images; we combined the valence of the scene context (positive or negative) with the valence of the depicted people/face and body expressions (positive, negative, or ambiguous) and whether there was a direct interaction among those people or not. Thus, there are stimuli with congruent or incongruent valences for scenes and people in the scenes. Employing representational dissimilarity analysis on human fMRI, some category-selective regions showed tuning to the valence of people and scenes for congruent stimuli, while different regions showed tuning to people's valence of incongruent images. We also observed different/contrasting representational content for congruent and incongruent subsets, e.g. neural representations of Extrastriate Body Area and Superior Temporal Sulcus were more correlated with interaction level for incongruent stimuli, but they showed more correlation with scene category for congruent ones. Deep Neural Networks like Emonet (an emotion predictor) or GUSE (a semantic model) also struggled to appropriately respond to incongruent stimuli. In sum, using our complex stimuli revealed a complicated and variable role of category-selective regions in integrative information processing underlying emotion recognition.

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Recurrent models of visual recognition

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Recognising straightforward visual stimuli is achieved in a bottom-up series of processing stages in the visual cortex, but real-world visual environments are intricate and challenging. When confronted with visual ambiguity, the non-feedforward, recurrent connectivity of the cortex supplies the computational capacity needed to tackle object recognition. Although evidence supports this involvement of recurrent processing, its precise role remains elusive. In the present study, we explored the role of recurrent processing by running behavioural tests in humans and artificial neural networks. Using neural networks allows to compare different emulations of brain architectures on a task, and compare it with human behaviour. To do so, we assembled a stimulus set designed to mimic the visual complexities of the natural world, by including various manipulations (e.g. occlusion) which are associated with recurrent processing. We ran a series of tests to compare recurrent and non-recurrent neural network models of visual recognition with the performances of human performing a categorisation task. Our results reveal a multi-faceted account of recurrence in artificial neural networks. While added recurrence seems to improve model performances on our visually challenging task, we cannot dissociate this from a model size effect. Looking beyond performance, we asked how the pattern of mistakes in our models fitted with that of humans, and found similarly that recurrence could not be dissociated from size. In summary, our data brings additional evidence that the computational power brought by recurrent processing in artificial models of visual recognition is not dissociable from that brought by model size.

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Development of the neural signatures of stream segregation and its contribution to speech perception in noise

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From classrooms to playgrounds, children communication occurs in noisy environments. Despite the peripheral auditory system reaching maturity approximately six months after birth, children have difficulties in perceiving speech in noise. Auditory segregation is a fundamental mechanism of auditory scene analysis, involving the organization of similar sound waves into a coherent stream, while distinguishing dissimilar acoustic components and attributing them to distinct sources. This process is closely associated with speech perception in noisy environments. Two Event-Related Potential (ERP) components have been identified as associated to auditory segregation: the Object-Relative Negativity (ORN) and the P400. The current study aims to investigate the development of the relationship between auditory segregation and speech perception in noisy environments, along with the maturation of the neurocorrelates associated with auditory segregation. Participants aged 8 to 27 (children n =17, adolescents n=13 and adults n= 20) performed in auditory segregation and speech perception in noise tasks. Behavioral results indicate an improvement in auditory segregation mechanisms and speech intelligibility in noise. Furthermore, our neurophysiological findings show a reduction in both the ORN and the P400 amplitude from childhood to adulthood.

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Exploring the role of the Visual Word Form Area in processing Sign Language

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The Visual Word Form Area (VWFA) is a brain region in the left ventral occipito-temporal cortex known to preferentially activate to written words and letters. It has been suggested that the specialization of VWFA for orthographic material stems from an inherent selectivity of this region for specific visual features, including foveal information, line junctions, and high spatial frequencies, enabling the development of a preference for letter shapes when acquiring literacy. Alternatively, some studies have suggested that VWFA serves as a gateway for transferring visual information to the linguistic system, independently of low-level visual features. The extent of each factor's contribution to the VWFA's specialization remains debated. To investigate this question, we leverage the expertise of individuals proficient in sign language. Sign language, akin to written language, conveys linguistic information through visual cues, but it relies on distinct visual properties, such as visual periphery processing and spatial information delivered through arm and hand movements. In our study, we characterized the brain activity to sign language in people (i) naïve to sign language, (ii) that learned sign language in adulthood or (iii) that have learned sign language in infancy before learning to read. Preliminary analyses suggest enhanced decoding of meaningful from meaningless signs in expert signers when compared to non-signers in VWFA, even after accounting for visual properties of sign video-clips. Comparable results are observed in the infero-frontal gyrus (IFG), a critical region for lexical processing. These findings support the view of VWFA as a railway for transferring visual information to the linguistic system, regardless of the visual features of the linguistic material.

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Revealing early learning skills during stimulus exposure: an EEG frequency tagging approach

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Visual statistical learning refers to the ability to detect and extract regularities from the environment. Thus far, infancy research has mostly investigated this ability with post-exposure behavioural tasks which only reveal the outcome of learning. These tasks may also lead to ambiguous interpretations since there is no clear consensus about the directionality of the learning outcome. Steady-state visual evoked potentials (SSVEPs) can be acquired while learning occurs and can shed light onto the temporal course of learning. At present, SSVEPs investigations of the ongoing learning processes have been limited to the auditory domain (Choi et al., 2020). Here we use SSVEPs to investigate infants' neural entrainment in response to visual regularities. Four- to six-month-old infants were presented with 20 s continuous streams of shapes at 6 Hz. They were randomly assigned to one of three conditions: standard doublet, control doublet, and random. We compared SSVEPs at the frequency of visual stimulation (6 Hz and harmonics) and at the doublet frequency (3 Hz and harmonics) across conditions. If the condition included visual regularities, we hypothesised a progressive response at 3 Hz. Results revealed neural entrainment at the base frequency that did not differ across conditions. On the other side, activity at the doublet frequency varied across conditions. Infants assigned to the standard doublet condition showed significantly greater responses at the doublet frequency compared to the random condition. Overall, these results suggest that the infant brain can detect visual regularities in a stream of shapes from very early on.

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Supramodal representation of numerosity in the human brain

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Humans and other animals can encode numerical information in a variety of formats and modalities, suggesting they can form an abstract representation of numbers in their mind. Which brain region implement such a generalized sense of number? We used fMRI to characterize the brain activity of participants processing numerical information (range 2-5) across various modalities (auditory, visual) and format (sequentially and simultaneously; symbolic and non-symbolic) to collect a comprehensive mapping of numerical representation across multiple dimensions. Preliminary results relying on Multivariate Pattern Analysis (MVPA) suggest that the right intraparietal sulcus can decode numerical information from non-symbolic condition. We will further use cross-modal MVPA analyses to investigate whether the brain patterns in right intraparietal sulcus are shared among those non-symbolic conditions.

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Neural basis of phonological representations from sounds and vision

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Speech is a multisensory signal. If the successive steps to compute abstract linguistic representations from auditory signals have been extensively explored, little is known on how visual speech is processed in the brain; and how auditory and visual speech input converge onto a unified linguistic percept. In this study, we used functional magnetic resonance imaging (fMRI) combined with multivariate patterns analyses (MVPA) to identify brain regions that are jointly involved in auditory phonology (phonemes) and visual phonology (visemes). Results from whole-brain searchlight analyses highlight a bilateral perisylvian network including the posterior middle (pMTG) and superior temporal gyrus (pSTG) and the pre- and post-central gyrus (PCG) that can decode phonological information from auditory and visual inputs. Among those regions, the pMTG and PCG also show significant crossmodal decoding. Using an ROI-based approach within the “Visual Word Form Area” (VWFA), we also observed above-chance classification accuracies for auditory and visual phonological units as well as a significant cross-modal classification. These results highlight that a distributed network of brain regions represents supramodal phonological information.

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Exploring the Interplay between Thermal Comfort and Cognitive Performance

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This project aims to investigate the intricate relationship between thermal comfort and cognitive performance, with a specific focus on evaluating the impact of ambient temperature on cognitive control. The significance of this research lies in its potential to unveil novel insights into the optimization of indoor environments for enhanced cognitive well-being.
The study will adopt a multidisciplinary approach, integrating principles from environmental psychology, neuroscience, and building science. By employing advanced sensor technologies, we will monitor and manipulate ambient temperature settings in controlled environments, allowing for a systematic examination of individuals' cognitive responses under varying thermal conditions.
To measure cognitive control, the project will utilize a numerical Stroop task coupled with EEG (electroencephalography) recordings.
The numerical Stroop task will assess cognitive control through reaction times and error rates, offering quantitative measures of participants' ability to inhibit automatic responses and maintain focused attention. Simultaneously, EEG recordings will provide real-time insights into the neural correlates of cognitive control, allowing for a comprehensive understanding of how thermal comfort influences cognitive functioning at the neurological level.
The outcomes of this research will contribute to the development of evidence-based guidelines for creating environments that promote optimal cognitive functioning. Ultimately, the project aims to bridge the gap between thermal comfort considerations in building design and the cognitive well-being of occupants, fostering environments that not only satisfy physiological needs but also support cognitive performance and overall mental health.

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Does Targeted Memory Reactivation during SWS and REM sleep have differential effects on mnemonic discrimination and generalization?

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Targeted memory reactivation (TMR), or the presentation of learning-related cues during sleep, has been shown to benefit memory consolidation for specific memory traces when applied during non-rapid eye movement (NREM) sleep. Prior studies suggest that TMR during REM sleep may play a role in memory generalization processes, but evidence remains scarce. We tested the hypothesis that TMR exerts a differential effect on distinct mnemonic processes as a function of the sleep state (REM vs. NREM) in which TMR is delivered. Mnemonic discrimination and generalization of semantic categories were investigated using an adapted version of the Mnemonic Similarity Task, before and after sleep. Forty-eight participants encoded pictures from eight semantic categories, each associated with a sound. In the pre-sleep immediate test, they had to discriminate “old” (targets) from “similar” (lures) or “new” (foils) pictures. During sleep, half of the sounds were replayed in slow wave sleep (SWS) or REM sleep. Recognition, discrimination, and generalization memory indices were tested in the morning. These indices did not differ between SWS and REM TMR groups or reactivated and non-reactivated item categories. Additional results suggest a positive effect of TMR on performance for highly similar items mostly relying on mnemonic discrimination processes. During sleep, EEG activity after cue presentation increased in the delta-theta and sigma band in the SWS group, and in the beta band in the REM TMR group. These results do not support the hypothesis of a differential processing of novel memory traces when TMR is administered in distinctive physiological sleep states.

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Feedback-evoked theta oscillations reveal underlying neural mechanism of cognitive flexibility

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Cognitive flexibility allows people to set adaptive behaviour in a complex and ever-changing world. The neural mechanisms supporting this ability require sophisticated coordination between various mental functions. Midfrontal neural oscillations in the theta frequency-band have been shown to play an important role in this coordination. Previous research has found that theta power is associated with feedback-related changes in behaviour. Additionally, cue-evoked theta oscillations have recently been shown to shift towards optimal frequency in response to task demand. However, it is yet unknown whether theta frequency shows the same demand related modulations in response to feedback as it does in response to cues. In the present study, we investigated this by letting participants (n=35) perform a reversal learning task in which one task-rule mapping was more demanding than the other while electrophysiological activity was measured using EEG. In contrast to previous findings of cue-evoked theta oscillations, our results do not show a frequency shift for feedback-evoked theta oscillations related to changes in behaviour. We did however, find a change in theta power related to changes in task-demand, thereby revealing a neurophysiological signature of the asymmetric switch-cost in the theta-band. We also replicated the finding that trials containing task-rule switches elicit a stronger theta response than other trials.

Memory, language & cognition - Poster 50

Inter-individual differences in brain activity patterns during semantic incongruence processing: An EEG study

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The brain's electrical activity in response to semantic violations has been researched for over 40 years (Kutas and Federmeier, 2011). Semantically incongruent (vs. congruent) stimuli evoke a more negative amplitude of the N400 component (Kutas and Hillyard, 1980). Moreover, a power increase in theta (4–7 Hz) (Hald et al., 2006), and a power decrease in alpha (8–12 Hz) and beta (13–30 Hz) bands (Kielar et al., 2014) were reported. Among many interpretations, N400 component indexes semantic processing, while changes in power reflect increased workload of the working memory and stimulus re-analysis after detecting semantic violations. The vast majority of these studies focus on group effects and, therefore, an individual-level approach is necessary.
This study investigates semantic incongruence processing from an individual-level approach by exploring the variability in the brain's electrical response in the time and frequency domains. We tested 45 neurotypical adults with a picture-word priming task while recording EEG signal. Two types of trials were presented: semantically congruent (matching picture and word), and semantically incongruent (mismatched picture and word).

Group analysis confirmed the presence of the N400 effect and power increase in theta band and decrease in beta band in response to semantically incongruent pairs. In inter-individual analysis, a significant N400 effect occurred only in about half of the sample, which suggests that it is not an automatic response. Analysis of changes in oscillations showed that the N400 effect is associated with changes in beta band, which seems to be responsible for semantic prediction during language processing.

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Validation of an ecological tool for assessing speech perception in noise

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In natural settings, listening conditions are seldom optimal. Humans have to distinguish between various simultaneous sounds and focus on the target speech while filtering out irrelevant information. In the presence of background noise, neurotypical adults shift their attention to visual cues and focus more on the nose and mouth area. Currently, there is no ecological tool available to assess speech perception in noisy environments. This study aims to validate an ecological tool for assessing speech perception in noise among adults. The material comprises 90 videos with 10 speakers introducing themselves in 9 phrases (hobby, favorite dish, pet, etc.)randomly assigned across three conditions: no background noise, signal-to-noise ratio (SNR)+10 dB, and SNR -10 dB. To validate the material, 44 adults with standard IQ were asked to repeat what they heard after each sentence. Eye-tracking data and percentage of correctly repeated words were analysed . We expect speech perception to decrease as the SNR decreases. Additionally, attention towards the mouth area is anticipated to increase with lower SNR, while focus on the eye area is expected to decrease.
A repeated measures ANOVA revealed a lower percentage of correctly repeated words as SNR decreases. Analyses on fixation durations show a significant effect of areas of interest with longer fixation durations on the mouth area (vs. the eye) and a significant interaction effect between areas of interest and level of background noise. Participants showed decreased interest in the eye area and increased focus on the mouth area with lower SNR.

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Functional connectivity patterns in semantic incongruence processing: An EEG study

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Semantic processing has been traditionally assessed with EEG by comparing brain activity for congruent and incongruent words, which results in the N400 effect. Nevertheless, the problem of functional connectivity related to semantic processing has been investigated in only a few studies. These studies emphasized that frontoparietal connections in the beta band are related to attentional selection and verbal working memory processes. This study aims to better understand brain functioning underlying the processing of semantic incongruence by estimating the strength of functional connections. We tested 43 participants with an EEG task that contained congruent or incongruent picture-word pairs. ERP and connectivity analyses (phased-locked value) were conducted. Group analyses showed the presence of an N400 effect in response to semantically incongruent stimuli. However, analyses of individual participants showed no N400 effects in 28 cases. Group analysis showed different patterns of functional connectivity mostly in alpha band during processing congruent and incongruent pairs. In addition, longer parietal beta band connections were observed in participants with N400 effects than without it. Moreover, in the group with N400 effect frontoparietal connections were stronger during the early processing period (0-250 ms), which is associated with the presence of attentional components (N1 and P2). In conclusion, the occurrence of the N400 effect may be related to the activity of frontal structures associated with attentional processes during stimulus processing. Thus, manipulating attention or using a more engaging procedure may help to further investigate the functional nature of the N400.

Development - Poster 53

The SensationaHL plasticity of the pubertal human brain

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Human brain development follows a unique trajectory, marked by a protracted period of neuroplasticity extending throughout adolescence. This sensitive period promotes experience-dependent adaptations in regions and networks supporting the cognitive and behavioural capacities required in dynamic social environments. For example, communication in larger groups is enhanced by the ability to track and discriminate voice signals in noise or in the presence of competing speech sounds. This may require a network of functionally and structurally connected regions including prefrontal cognitive control, parietal cross-modal association, and the fine-tuning of temporal auditory voice perception. Although chronological age-related variation has been well-described, defining how and when these changes occur throughout adolescence is challenging due to emergent pubertal hormones. We aim to disentangle the neuroplasticity mechanisms linked to pubertal stages and hormonal markers, focusing on brain regions serving complex cognitive and auditory skills. The SensationaHL cohort will be recruited (n = 236) for longitudinal pubertal stage transition and cross-sectional (age- and sex-matched) pubertal stage assessment, surrounding puberty onset and offset. Pubertal hormone and stage data will be collected at baseline and 6-month intervals, in addition to cognitive and auditory speech-perception tasks. Magnetic resonance spectroscopy, diffusion imaging, and magnetoencephalography will provide baseline and two-year follow-up measures of neurotransmitters and structural and functional connectivity, to infer upon the mechanisms of neuroplasticity involved. We hypothesize a relationship between myelination and pubertal stage, extending past puberty-offset and into late adolescence. Moreover, we predict an association between improvement in complex auditory skills, executive function, and puberty-associated glutamate increases supporting neuroplasticity.

Development - Poster 54

Stress-regulatory effects of oxytocin in children with autism and intellectual disability: A Study Protocol

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Intranasal administration of oxytocin, an endogenously produced neuropeptide, is increasingly considered as a novel therapeutic option for mitigating social difficulties and regulating stress in autism. However, previous oxytocin administration studies primarily focused on clinical behavioral outcomes, often lacking objective biophysiological markers. Including these markers is crucial, especially given the described autonomic nervous system dysregulation in autistic individuals, particularly in terms of parasympathetic nervous system (PNS) control. Chronic cardiac PNS withdrawal has been well documented in the autistic community, bearing implications for the social communication challenges observed in autistic individuals, as cardiac PNS withdrawal is associated with impaired social skills, compromised executive functioning, and heightened behavioral problems. Therefore, this study aims to investigate the stress-regulatory effects of oxytocin and identify potential biophysiological markers, particularly in autistic individuals with co-occurring intellectual disability (ID). This population, characterized by a heightened prevalence and an exacerbated need for therapeutic interventions, has been routinely excluded from research, despite their pronounced PNS withdrawal and associated complications.

We present a double-blind, randomized, placebo-controlled trial investigating the effects of intermittent intranasal oxytocin administration (4 weeks, 24 IU 3x/week) paired with standardized psychosocial stimulation training in 80 autistic children with co-occurring ID. Objective biophysiological measures of resting-state electrocardiography (ECG) high-frequency heart rate variability (HF-HRV), an established marker of cardiac PNS activity, electroencephalography (EEG), respiration, and skin conductance will be assessed immediately post-administration and at a four-week follow-up session. These findings will contribute to the identification of an objective biophysiological marker and offer valuable insights into oxytocin's stress-regulatory effects.

Development - Poster 55

Behavioral effects of multiple-dose intranasal oxytocin intervention in children with autism and intellectual disability: A study protocol

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Introduction. In recent years, oxytocin nasal spray has been increasingly explored as a potential intervention for autism given its beneficial effects on both social communication and repetitive and restrictive behaviors and interests. Despite the fact that around 40% of the children with autism have a co-occurring intellectual disability (ID), leading to poorer outcomes, no research has been conducted into the effect of oxytocin in children with autism and ID. Participants and Methods. In this double-blind randomized placebo-controlled trial, 80 children with autism and ID (6 – 13 years) will be assigned to either the placebo or oxytocin condition for a four week nasal spray administration (24 international units/day). The spray will be given intermittent and is followed by a standardized play session in order to stimulate the social areas of the brain. To capture oxytocin-induced effects on the main characteristics of autism, the Brief Observation of Social Communication Change (BOSCC) will be used. The BOSCC will be taken by a clinician at three timepoints; before the intervention (T0), immediately after the intervention (T1) and at one-month follow-up (T2). Parents' and teachers' observations of possible behavioral changes will be assessed using the 'Autism Treatment Evaluation Checklist' (ATEC) and 'Repetitive Behavior Scale – Revised' (RBS-R). These questionnaires will be taken at the same timepoints as the BOSCC. Together, these results will generate important insights into the effect of oxytocin on the core autism symptoms, which may aid in establishing relevant intervention methods for improving the quality of life within children with autism and ID.

Development - Poster 56

A study protocol: oxytocin administration for children with autism and co-occurring intellectual disability: caregivers' perspectives, expectations and experiences

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Introduction. Intranasal administration of the neuropeptide oxytocin is increasingly studied as a novel pharmacological approach to support stress-relief and social development in children with autism. However, children with autism and co-occurring intellectual disability (ID), who are in the highest need for novel support, have been highly neglected in research. Moreover, information on what caregivers think and expect from oxytocin administration and how they experience it, is currently lacking. Therefore, we aim to investigate caregivers' perspectives, expectations and experiences regarding oxytocin administration for children with autism and co-occurring ID. This will allow assessing oxytocin's desirability and acceptability for the targeted population, while exploring its position in the neurodiversity perspective.
Participants and Methods. In-depth, open-ended, semi-structured interviews will be conducted with parents and schoolteachers of children with autism and ID, recruited via special needs schools in Flanders, Belgium, in the context of a double-blind, randomized, placebo-controlled clinical trial investigating the efficacy of oxytocin administration in children with autism and ID. Besides, also health care providers from multiple rehabilitation centra in Flanders for children with autism will be interviewed. Interviews will be audio-recorded, transcribed verbatim, and analyzed by means of thematic analysis, according to the Qualitative Analysis Guide of Leuven (QUAGOL). NVivo V12 software will be used to facilitate data management and analysis, and the Consolidated Criteria for Reporting Qualitative Research (COREQ) will be used to enhance the rigor of the study. Data will be managed confidentially. The study has been registered and received ethical approval.

Development - Poster 57

The development of rapid face categorization: Evidence from frequency-tagging EEG in a large cohort of infants, children and adults

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Scalp electroencephalography (EEG) is routinely used to study perceptual development. However, standard EEG approaches make it difficult to extract comparable information across developing populations. Here, we report the development of face-selective neural activity using frequency-tagging EEG to isolate a neural marker of rapid face categorization across age groups. We gathered published and novel data collected in 5 groups (N=140 in total): 4-to-6-month-olds (N=27), 8-to-12-month-olds (N=26), 5-year-olds (N=33), 10-year-olds (N=27) and 22-year-olds (N=27). All groups were exposed to similar fast periodic visual stimulations, where various face exemplars were presented at a fixed interval within streams of nonface stimuli to tag 2 distinct neural responses at distinct frequencies and harmonics (integer multiples): a general visual response to all stimuli (6 Hz) and a face-selective response (1.2 Hz) reflecting rapid face categorization. We show that while the face-selective response is already present in the youngest infants, its reliability and amplitude increase with age at lateral posterior regions. The response is observed on a single harmonic at 4-6

months and becomes progressively distributed on more harmonics, reflecting a mono-component slow response starting from 230 ms after stimulus-onset at 4-6 months that evolves to a faster (from 100 ms) multi-component response in adults. In contrast, the general visual response, related to more basic visual function, is reliably high from the youngest age tested, with a comparable distribution across harmonics and age. Overall, using the same approach across age groups, we characterize the development of a neural signature of rapid face categorization from infancy to adulthood.

Development - Poster 58

The applicability of optically pumped magnetoencephalography pushed toward early human life

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Characterizing the early development of the human brain is critical from both fundamental and clinical perspectives. However, existing neuroimaging techniques are either not well suited to infants or have limited spatial or temporal resolution. The recent advent of optically pumped magnetometers (OPMs) has revolutionized magnetoencephalography (MEG) by enabling wearable and thus naturalistic recordings while maintaining excellent sensitivity and spatiotemporal resolution. Nevertheless, its adaptation to study brain activity in infancy poses several challenges. We present an OPM-MEG setup suited for newborns and demonstrate its usability in this population with two auditory paradigms. The first consisted of a single tone presented at short random intervals. Our OPM-MEG setup successfully recorded auditory-evoked responses peaking around 250 ms poststimulus and whose corresponding magnetic topography displayed the expected bi-dipolar pattern over the temporal regions. The second paradigm was a frequency tagging paradigm in which tones were presented at a 3 Hz rate in trains of 3 base tones followed by one oddball tone. The power spectrum SNR of the OPM data displayed significant peaks at the base and oddball frequencies. Moreover, we assess the added value of using triaxial OPMs and showed that tangential axes might be better suited to uncover significant responses. Finally, we compare the OPM responses with those obtained from the same participants using cryogenic MEG and evidenced that the amplitude of the responses was significantly higher with the former, though SNRs did not differ. Overall, this work provides the foundation for future OPM investigations of typical and pathological early brain development.

Development - Poster 59

Neural sensitivity to eye gaze in infants at elevated likelihood of autism

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Autism spectrum disorder (ASD) is a neurodevelopmental condition, characterised by challenges in social communication and interaction, including eye contact. Yet, early diagnosis of ASD -based on behavioural characteristics- remains challenging. Electroencephalography (EEG), for instance, may be a promising tool to pinpoint early ASD characteristics in infants at elevated likelihood (EL) of ASD. Throughout a prospective longitudinal study, we monitored the development of 91 EL infants (i.e. born prematurely or having an older sibling with ASD). Event-related potentials (ERPs) to direct and averted gaze were collected at 10 and 14 months of age, and at three years, we established a best-estimate research diagnosis of ASD. Using the EEG paradigm of Elsabbagh et al. (2012), we aimed to evaluate whether ERPs to eye gaze could predict later emerging autism. Data analysis revealed selective P1, N290 and P400 ERPs. Yet, in contrast to Elsabbagh et al. (2012), the differential P400 response for dynamic eye gaze shifts was not replicated in infants who received a best-estimate ASD diagnosis. Group comparisons only demonstrated significantly longer N290 latencies in EL-non-ASD versus EL-ASD infants when dynamic gaze shifted towards them. Furthermore, in EL-ASD infants, longer P1 latencies were found at 10 versus 14 months, as well as generally shorter N290 latencies when dynamic gaze shifted toward versus away. We reliably detected the three ERP components in this cohort of EL infants. However, these neural responses did not allow to reliably discriminate between infants who did and who did not receive a best-estimate ASD diagnosis at three years.

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Does atypical face processing underlie social difficulties in school-aged preterm-born children? A frequency-tagging EEG approach

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Preterm (PT) birth is associated with important socio-communicative vulnerabilities that can have long-term implications and may result in psychopathology (e.g., autism spectrum disorder). A recurring “preterm behavioural phenotype” has been described, although these difficulties may often be subtle and subclinical. As face processing is crucial for social interactions and several studies reported impaired face processing in PT populations, we hypothesize that altered face processing may underlie these social difficulties. Here, we investigate the long-term impact of PT birth on the quality of socio-communicative sensitivity in school-aged children. Thirty-nine 8-to-12-year old PT children born between 24 and 32 weeks of gestation and thirty-eight age- and gender-matched term-born controls participated in our study. All children underwent an extensive multimodal test battery, comprising several neural measures (MRI and EEG), autonomic nervous system stress physiology, eye-tracking, standardized observations, questionnaires and endocrinological measures. We investigated facial expression and identity discrimination using innovative frequency-tagging EEG-paradigms. More specifically, we evaluated the neural sensitivity of our PT participants to implicitly and automatically discriminate emotional (fearful and happy) faces among a stream of neutral faces, and to discriminate a different facial identity among a stream of identical faces. We found successful implicit facial expression and identity processing in both groups. Unexpectedly, the PT participants showed a significantly greater neural sensitivity towards these subtle socio-communicative facial cues compared to their term-born peers. Correlations with neonatal measures such as gestational age and birth weight showed that this greater neural sensitivity is uniformly present among the PT group.

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Development of the Neural Correlates Underlying Semantic Processing in Toddlerhood: Changes in the N400 and Theta Power

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The second half of the first year of life marks the beginning of children's rapid vocabulary growth. Semantic integration is a mechanism underlying lexical-semantic processing and facilitating long-term vocabulary acquisition. In adults and children, theta band co-occurs as a neural marker of semantic integration together with N400 ERP. Although similar semantic tasks evoke both, they likely reflect unique aspects of semantic processing. Moreover, factors such as age and vocabulary skills seem to affect them differentially (Schneider, 2023). Only a small number of studies have examined theta-band oscillatory power in young children, with inconclusive results (Poudel, 2021; Schneider, 2018). To date, no studies have investigated the development of these two neural correlates and their modulators in toddlerhood to further characterize semantic processing early in life. This study aims to investigate changes in theta power in response to semantic incongruence during toddlerhood. Moreover, to understand the dynamics of brain development, the relationship between N400 magnitude and changes in theta power will be examined. In addition, based on Schneider's (2023) results, we expect different effects of age and vocabulary size on theta power and N400 magnitude. We are testing 18- (N = 40) and 24-month-old (N = 34) Polish monolingual toddlers in a cross-sectional and longitudinal design (N = 21) using a semantic priming procedure (congruent and incongruent picture-word trials) while recording EEG, and acquiring a vocabulary questionnaire. We will test relations between N400 magnitude and theta power with Linear Mixed Models regression analysis. Due to ongoing pre-registration, data are not analyzed yet.

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Where is mom? Assessing facial identity processing in infants using frequency-tagging EEG

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Infants have a natural interest in faces and communicate with others by 'reading' faces. Preterm infants are at risk for socio-emotional difficulties, including an increased prevalence of autism spectrum disorder (ASD). Therefore, detailed monitoring of early socio-emotional and socio-communicative development is a valuable avenue for early detection and prevention of future psychopathology in this high-risk population.
We apply frequency-tagging EEG, a technique which offers a fast and reliable approach. Basically the brain responds at exactly the same periodicity as the frequency of visual stimulation. Based on this principle, an oddball familiar face discrimination paradigm was administered to a group of term-born and preterm infants, both at the age of 5 and 10 months). In particular, we investigate discrimination and neural saliency of the mother's face versus a stranger's face by presenting a stream of faces that are unknown to the infant at 3 Hz presentation rate, with highly variable images of their mother's face interleaved at 1 Hz oddball rate. Sensitivity for automatically detecting and categorizing the face of their mother is quantified by the EEG-amplitude at the oddball frequency.
Results indicate that in the group of term-born infants, a robust mother face categorization response is detectable, both at 5 and 10 months. Strikingly, in spite of similar attention allocation and base rate responses, no significant oddball responses indexing mother face categorization are found in the group of preterm infants. This suggests that the neural representation of the maternal facial appearance is less robust and established in this preterm sample.

Perception & awareness - Poster 63

Pattern of associations across categories in visual recognition

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Localized brain damage can result in relatively specific problems in mental faculties, including problems with visual recognition. It is still a matter of debate why certain deficits and combinations of deficits occur in visual recognition. Recent evolutions in human neuroscience have revealed the complexity of the system that supports visual recognition. However, it remains unknown how the visual recognition of different object categories is associated with each other. Our project aims to acquire a reliable measurement of the various dimensions that might define the pattern of associations across a wide range of categories. For this purpose, we have developed a new test battery consisting of recognition tasks involving multiple categories. The first data of the project reveals correlations and underlying factors in the performance across different categories among participants. In subsequent stages, our goal is to demonstrate how the performance associations between object categories in healthy individuals and the neural overlap in the healthy brain is related to the representational overlap in Deep Neural Networks (DNNs). Importantly, we aim to illustrate to what extent the pattern of deficits observed across object categories in stroke patients can be explained by the information processing in DNNs, enabling us to replicate the entire spectrum of human recognition deficits in artificial intelligence models.

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Low autonomic arousal mediates mind-blanking report occurrences

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Mind-blanking (MB) is termed as the “experience of inability to report any immediate mental content”. In terms of mechanisms, a link between MB and cortical arousal has been proposed (REF)Here, we aim to test whether MB reports can also ensue from autonomic arousal manipulations. Using experience-sampling we examined the prevalence of MB reportsa) baseline, b) a high-arousal inducing condition (high-intensity exercise), and c) low-arousal inducing condition (8-hour sleep deprivation). In a repeated-measures design, 18 typical participants (11 females) were requested to lay restfully and report their thoughts every 2 minutes via button press, by opting across a) sensations, b) mind-wandering and c) blanks across the three conditions. We found that, MB was reported less frequently compared to other mental states across all conditions ($F=46.97$, $p<.000$), with MB reports being more frequently reported during sleep deprivation (logistic regression, $beta=0.36$, $p<.002$). MB also tended to be reported more slowly compared to other mental states ($F=28.64$, $p<.000$), an effect modulated by arousal, as post-exercise MB tended to be slower than other MB reports ($F=5.81$, $p<.001$), potentially reflecting different levels of absorption. Finally, a sequence analysis of mental reports showed that sleep deprivation increased the probability of sensations and MB. Inversely, post-exercise increased mind-wandering thoughts. Our results stress that MB is an arousal-modulated mental state and highlight the importance of physiological arousal in how thoughts evolve.

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Cues accounting for the horizontal tuning of human face identity recognition

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Human identity recognition recruits specialized visual mechanisms that preferentially rely on the horizontal content of the face stimulus. Here I will present works addressing the nature of the information contained in the horizontal range of the face stimulus. A parallel project shows that the identity cues conveyed by the horizontal range are the most stable across viewpoints and predict viewpoint-tolerant identity recognition in humans. The present project investigates how inversion and negation affect the horizontal tuning of human face recognition as these manipulations are thought to prevent access to distinct sources of information: feature configuration and surface properties, respectively. Participants performed a face identity recognition task using famous actors face-images. Orientation-filtered images (from 0° to 150° in steps of 30°) were presented upright with a positive contrast, inverted, or negated. We modeled the inversion and negation effects across orientation using a Bayesian Gaussian mixed model. Overall, inversion impaired sensitivity more strongly than negation but the orientation profiles of the inversion and negation effects were correlated and described a similar gaussian, peaking in the horizontal range. This indicates that inversion and negation similarly disrupt the access to the oriented content of the human face. The horizontal range of face information being the most vulnerable to these image manipulations which −though radically different at the pixel level− are especially harmful to face perception, indicates that this range provides access to the optimal configural and surface cues for the specialized processing of face identity. Altogether our findings suggest that the horizontal range is essential for face identification not only because it conveys feature configuration, but also the surface cues that are crucial for the tolerant representation of human face identity.

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Task-independent neural bases of peer presence effect on cognition in children and adults

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All behaviors can be changed by the mere presence of an observer, positively (social facilitation) or negatively (social inhibition), Yet, the neural mechanisms orchestrating such ubiquity remain poorly understood. Even less is known about when they emerge during childhood. To address these issues, fMRI data were collected in children (age: 10-13) and adults alternately observed and unobserved by a familiar peer while they compared either the number of dots in two arrays or the sounds of two written words, i.e., engaged basic skills foundational to math and reading, respectively. Consistently with earlier behavioral findings, peer observation facilitated both tasks, and children's improvement was comparable to adults'. Contrary to our expectations, no main observation-driven change was found within the task-specific neural substrates of numerosity and phonological comparisons. Rather, whole-brain analyses revealed a unique neural signature of observation for both tasks, largely shared by children and adults. This task-independent signature encompassed widespread changes in several brain networks known for their domain-general involvement in social cognition (especially mentalizing), attention, and reward. Children's pattern of observation-driven neural changes largely resembled adults', with the exception of the attention network, and particularly the anterior right TPJ. Only in adults did this area show a lesser deactivation in observed relative to unobserved trials. These findings indicate that social facilitation of some human education-related skills i) is primarily orchestrated by domain-general brain networks, rather than by task-selective substrates, and ii) matures relatively early in the course of education, thus having a protracted impact on academic achievements.

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Task-independent neural bases of peer presence effect on cognition in children and adults

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All behaviors can be changed by the mere presence of an observer, positively (social facilitation) or negatively (social inhibition), Yet, the neural mechanisms orchestrating such ubiquity remain poorly understood. Even less is known about when they emerge during childhood. To address these issues, fMRI data were collected in children (age: 10-13) and adults alternately observed and unobserved by a familiar peer while they compared either the number of dots in two arrays or the sounds of two written words, i.e., engaged basic skills foundational to math and reading, respectively. Consistently with earlier behavioral findings, peer observation facilitated both tasks, and children's improvement was comparable to adults'. Contrary to our expectations, no main observation-driven change was found within the task-specific neural substrates of numerosity and phonological comparisons. Rather, whole-brain analyses revealed a unique neural signature of observation for both tasks, largely shared by children and adults. This task-independent signature encompassed widespread changes in several brain networks known for their domain-general involvement in social cognition (especially mentalizing), attention, and reward. Children's pattern of observation-driven neural changes largely resembled adults', with the exception of the attention network, and particularly the anterior right TPJ. Only in adults did this area show a lesser deactivation in observed relative to unobserved trials. These findings indicate that social facilitation of some human education-related skills i) is primarily orchestrated by domain-general brain networks, rather than by task-selective substrates, and ii) matures relatively early in the course of education, thus having a protracted impact on academic achievements.

Perception & awareness - Poster 68

Nihil in intellectu nisi prius in sensu?: Knowledge and conceptualisation of olfactory information without the sense of smell

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How do sensory deprived people conceive the things they cannot experience with their senses? The study of people born without olfaction represents a particularly interesting model to tackle the role sensory experience plays in getting knowledge: 1) olfaction is a sensory quality that does not easily “remap” onto other properties of the other senses (e.g. you cannot see, hear or touch smell) and 2) it has been demonstrated that, compared to the other senses, olfactory information is poorly accessible through language. To determine whether sensory experience is necessary for odour knowledge, we asked congenital anosmic participants (N=20) and matched controls (N=20) to categorise and sort words with various olfactory values across five different tasks (property generation; card sorting; odd-one out; drag and rate; knowledge of the words) and two different conditions (neutral and olfactory). Our results show that despite important similarities between congenital anosmic and normosmic people, there are nevertheless interesting discrepancies in the way they think about the olfactory content of things. This suggests that anosmic people can develop a deep representation of odors even without ever experiencing them. However, such representation differs from the one of control people in significant ways, showing how sensory experience partially shapes our mental representation of things.

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How Radial Biases influence fast saccades towards Faces in the Periphery

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Saccadic choice studies have demonstrated that faces are more rapidly and accurately foveated in the periphery than other stimuli, such as animals, objects and scenes. These studies typically present images along the horizontal meridian, which facilitates access to horizontal cues due to radial biases in the periphery. We recently showed that the visual mechanisms specialized for the processing of faces in the periphery engage more strongly along the horizontal meridian likely due to a facilitated access to the horizontal face cues, which convey the most diagnostic cues for face identity recognition.
The present study addresses the extent to which radial biases also modulate the saccadic advantage for faces in the periphery. In a saccadic choice task, we will present faces and vehicles in the periphery either horizontally or vertically and compare the latency (in milliseconds from the onset of stimuli) and accuracy (% error) of saccades in both conditions using a Bayesian linear mixed-effects model. We anticipate that the reduced access to horizontal information in the vertical meridian will decrease the saccadic advantage for faces. The findings of this study will shed light on the mechanisms underlying face perception in the periphery and could challenge the widely shared assumption of a general saccadic advantage for the processing of faces.

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

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One of the hallmarks of human cognitive flexibility regards 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. To this end, we will primarily utilize MVPA, such as decoding and representational similarity analysis, to characterize this neural implementation. On each trial, participants were asked to perform one of nine possible cued image categorization tasks. 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 relevant task representations accordingly. We recently collected fMRI data from 45 participants. Our preliminary, first results reveal different brain regions that may be involved in monitoring task uncertainty or the modulation task representations, and believe further analyses hold the promise of revealing the underlying neural architecture that supports human flexible goal setting.

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Probing the functional relationship between ongoing oscillations and pain perception with intracerebral recordings form the human insula: preliminary data

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Our aim is to elucidate the role of the insula in the potential functional relationship between the modulation of ongoing oscillations and pain perception. As distraction/cognitive load is known to influence pain perception, we investigated whether changes in perception induced by an arithmetic task would lead to congruent changes in the modulation of ongoing oscillations. 6 patients undergoing pre-surgical evaluation for treatment of refractory epilepsy, with electrodes implanted in the anterior or posterior insula, were recruited (age: 34±7 years old, 2 female). Sustained periodic thermonociceptive and vibrotactile stimuli were delivered at a frequency of 0.2 Hz. Patients were exposed to two conditions during the stimulation: baseline and arithmetic task. After each trial, subjects provided a verbal rating of stimulus intensity on a numerical rating scale [0-10]. Linear mixed models were used to assess the effects of condition and modality on the intensity ratings, the phase-locked periodic EEG response, and the modulation of ongoing oscillations at the frequency of stimulation. During the distraction task, perceived stimulation intensity was lower than baseline, with a stronger effect during vibrotactile stimulation ($p<0.001$). Similarly, the phase-locked EEG response in the posterior insula showed lower amplitudes during distraction ($p=0.023$, $p=0.006$). Ongoing oscillations in the anterior insula followed a similar pattern, especially following thermonociceptive stimuli in the alpha and theta frequency bands. This preliminary data suggests that the ongoing oscillations recorded from the insula might be functionally involved in the modulation of intensity perception, but not preferentially for pain perception.

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Visual and tactile motion-directions are aligned in external space in hMT+/V5

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Motion-directions can be perceived through vision and touch. This motion information coming from the different senses should align in the human mind to carry out optimal goal-directed tasks. The alignment is not trivial since vision and touch are initially coded in different spatial frames of references and the body parts can change postures, which eventually change the external coordinates while keeping the somatotopic coordinates intact. Is there a brain region where the direction of visual and tactile motion is coded using a common frame of reference independent of body-posture? To address this question, we characterized the brain activity of participants using fMRI in two experiments. A first experiment relying on a whole-brain univariate approach revealed that in addition to sensory specific motion selective regions (S1 for touch; V1 for vision), the middle occipito-temporal region (hMT+/V5) is selective to both visual and tactile motion. In a second experiment, we delivered directional visual and tactile motion stimuli across different hand postures. Multivariate pattern analyses revealed that motion-directions can be decoded in both vision and touch in hMT+/V5, and more so, when touch was mapped using an externally-centred coordinate system as compared to a somatotopic frame of reference. Crossmodal decoding further showed that tactile motion-directions defined using an externally centred coordinate system, but not a somatotopic one, align with the representation of visual motion-directions in hMT+/V5. Our results show that motion-directions in vision and touch are aligned in hMT+/V5 and anchored onto a common external frame of reference.

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Decoding visual and auditory spatial frequencies from motion in area hMT+/V5

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The hMT+/V5 region encodes spatial frequencies from moving visual stimuli. Recent research demonstrated that hMT+/V5 also represents moving auditory stimuli. However, it remains unknown whether hMT+/V5 codes for spatial frequencies related to moving sounds. We used 7-Tesla functional magnetic resonance imaging (fMRI) to characterize brain activity of people exposed to visual and auditory stimuli, both featuring translational motion in the horizontal axis and two distinct spatial frequencies (low and high). In the visual domain, we presented moving gratings with low and high spatial frequencies, while for the auditory domain we presented moving sounds covering a fixed spatial distance created in laboratory setting produced using a varying number of source speakers, simulating the spatial frequency used in the visual domain. Multivariate pattern decoding analyses revealed that the anterior and posterior portions of bilateral hMT+/V5 decode spatial frequencies from moving visual inputs. Interestingly, the anterior portion of left hMT+/V5 decodes spatial frequencies from sounds. Non-significant cross-modal decoding, however, suggests that visual and auditory modalities do not share the same pattern of activity for different spatial frequencies. These findings suggest that the anterior portion of hMT+/V5 encodes spatial frequencies in both vision and audition, while maintaining distinct representational geometries of spatial frequencies across the senses.

Clinical population & others - Poster 74

Investigating the functional connectivity brain processes related to procedural learning skills in self-limited focal epilepsy

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Background. The functional brain processes underlying procedural learning (PL) remain unexplored in children with self-limited focal epilepsy (SLFE), preventing a proper understanding of their cognitive and motor disabilities. To fill this gap, we investigated the PL-related functional connectivity brain processes and associations with behavioural performance in children with SLFE. Methods. PL-related changes in resting-state Functional brain Connectivity (rsFC) were recorded using magnetoencephalography in 16 (7 to 11 years old) children with SLFE. After removing artefacts and interictal epileptic discharges (IEDs) from the rsFC data through independent component analyses, a functional connectome was estimated using band-limited power envelope correlation in a remaining group of 10 children with SLFE compared to 28 matched typically developing (TD) children further submitted to statistical analyses. PL, motor, language and cognitive abilities were also assessed. Correlations were computed between PL-related changes in rsFC, IEDs and specific behavioral performance. Results. PL-related FC processes were found mainly reduced in SLFE compared to TD within a specific cortico-striato-cerebellar network in the theta, alpha and low

beta frequency bands. Children with SLFE also showed reduced motor coordination and PL performance, the latter being negatively correlated with the frequency of sleep IEDs. Further associations were observed between PL-related FC processes and motor performance or IEDs during wakefulness. Discussion. We observed reduced PL abilities in SLFE and found atypical PL-related changes in rsFC to be associated with poor motor performance and a higher proportion of IEDs. These results suggest that IEDs may have disrupted brain-behaviour PL and motor coordination abilities in SLFE.

Clinical population & others - Poster 75

Exploring the effects of a single-dose intranasal oxytocin administration combined with sensorimotor synchronization therapy on social attunement in autism

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During social interaction, behavioral patterns and neurophysiological processes are bidirectionally exchanged between the interacting partners. In recent neuro-affective research approaches, this is referred to as biobehavioral synchrony. However, for individuals with autism spectrum disorder (ASD), who may experience challenges in social interaction and communication, this social attunement may be atypical. Interestingly, previous studies suggest that coordinated body movements hold promise in fostering feelings of affiliation, enhancing social attunement, and elevating endogenous oxytocin levels, whereas the intranasal administration of oxytocin has been demonstrated to alleviate some of the social interaction difficulties experienced by individuals with ASD.
In the present study, we will quantify the social attunement of 8-to-12-year old children with ASD and matched neurotypical controls in a series of real-life dyadic interaction paradigms using dual multimodal biobehavioral measurements, including EEG responses, heart rate, skin conductance, eye-contact, pupillometry, and saliva samples for endogenous hormone analysis. Furthermore, we will explore the potential to modulate these biobehavioral signals. We will explore the effects of a single-dose intranasal oxytocin administration combined with sensorimotor synchronization therapy on the social attunement, sociability, and endogenous oxytocin levels. With this innovative combined intervention approach, we aim to target the core social difficulties in ASD, by restoring the underlying oxytocin system, and enhancing dyadic attunement and reciprocity.

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Involvement of physiological reactivity and interoception in emotional experience after a traumatic brain injury: preliminary results

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After a traumatic brain injury (TBI), patients often report a decrease in their ability to feel emotions, which is partially based on physiological reactivity (PR) associated with the emotion and on the ability to become aware of it, referred to as interoception. After a TBI, alterations of interoception and PR have been reported. This study aimed to explore the role of PR and interoception in emotional experience after a TBI. 17 men with moderate to severe TBI (age: 40 ± 12,4) and 17 healthy men (age:37,9 ± 15,8), paired on age and educational level, participated in the study. We examined PR through the electrodermal activity (EDA) while participants watched positive and negative emotional films that they rated emotionally, and interoception through a heartbeat counting task (HBCT) and the MAIA questionnaire. Compared to controls, TBI patients had lower scores on the emotional awareness subscale of the MAIA; the assessment of arousal for negative films was positively correlated with HBCT scores. Furthermore, TBI patients showed lower EDA during negative films which they rated as less arousing. These results suggest a decrease in interoceptive emotional awareness, as well as in the assessment of arousal and PR for negative stimuli after TBI. The decrease in emotional experience reported by TBI patients could be explained by both reduced PR and underestimation of it due to lower interoception.

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C9orf72-repeat expansions impact socio-emotional brain function at the premanifest disease stage

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Background: Hexanucleotide repeat expansions in the C9orf72 gene (C9RE) are the most common genetic cause of both frontotemporal dementia (FTD) and amyotrophic lateral sclerosis (ALS), which are associated with deficits in facial expression recognition. However, the understanding of neurofunctional changes during the premanifest stage remains limited. Additionally, emotion has a significant impact on memory processing and contemporary models of episodic memory posit that an event's emotional valence strongly influences future recall, which is compromised in both FTD and ALS, yet the functional neuroanatomy is not well understood. Methods: We included 21 premanifest C9RE (preC9RE) carriers, and 24 controls. Participants encoded stimuli of angry faces, neutral faces and houses, followed by an immediate recognition task. We conducted mass-univariate and multi-voxel pattern analyses to investigate the impact of C9RE on neural response amplitude and multidimensional neural patterns. Furthermore, we applied a reverse inference approach and decoded the cognitive impact of C9RE. Results: The results revealed decreased neural selectivity in the anterior and middle cingulate cortex, and hippocampus in preC9RE. Whole-brain neural pattern analyses revealed above chance classification of groups in the bilateral anterior insula and cingulate cortex. Encoding-retrieval neural similarity was decreased in each of the three networks. The brain wide multidimensional impact of C9RE linked with the default mode network state, as reported the neuroimaging literature. Conclusions: The findings highlight socio-emotional functional changes at the preC9RE stage. The local impact is primarily situated in the salience network, with a notable impairment in the reinstatement of encoding patterns during recognition.

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MRI-abnormalities in developmental prosopagnosia and their association with symptom severity: a brain-behavior study 65 cases

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Developmental prosopagnosia (DP) is a neurological condition characterized by face recognition difficulties, despite having intact low-level vision and no intellectual impairment or brain damage. The disorder can significantly impact the social functioning of an individual due to difficulties in recognizing friends, family members, and even oneself in the mirror, leading to social anxiety. The neural basis of DP remains unclear. The study aims to investigate the structural neuroanatomical differences between DP and healthy controls, and the association of those differences with symptom severity.
Using structural imaging, we pooled samples from 4 sites and compared grey matter volumes and cortical thickness from a total of 65 individuals with DP (44 F, age= 38.2 ± 12.2) and 94 healthy controls (59 F, age= 37.11 ± 9.47). We performed ROI-based volumetric and vertex-based analyses, controlling for age, gender, eTIV (estimated total intracranial volume), and site, where appropriate. The results revealed significantly lower grey matter volume in DP in the right fusiform gyrus and pallidum as well as in the bilateral hippocampi and ventral diencephalon. In the DP group, multiple regression analyses revealed that the symptom severity was associated with lower grey matter volume in both the hippocampi and ventral diencephalon bilaterally. Cortical thickness showed neither a difference between DP and healthy controls nor an association with symptom severity. The findings suggest a key role for the memory circuitry in DP and support the hypothesis of a domain-general deficit. The results may pave the way for the development of interventions focused on visual memory.

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Hemodynamic response measured by time domain diffuse correlation spectroscopy during Hyperventillation on healthy subjects

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Cerebral blood flow (CBF) is a physiologically relevant parameter that is not routinely measured in clinics because of the lack of a reliable and easy to apply bedside technology. However, management of CBF is essential in neurosurgery and neurology [1]. One of the main and well-known challenges with adapting optical neuromonitoring techniques to adult patients is dealing with limited depth sensitivity, which is caused by substantially greater light interactions in superficial tissues (i.e., scalp and skull) compared with the brain. As a consequence, fluctuations in scalp hemodynamics can overshadow brain-related signals. Time-domain diffuse correlation spectroscopy (TD-DCS) is an optical method to evaluate CBF and is a known method to minimal the effects of superficial layer and blood flow changes in skin. In TD-DCS technique the autocorrelation function is computed for a given time gates within the measured distribution time of flight of photons (DTOF) and the depth resolution is achieved by the selected time gate. It's supposed photons in earlier and later time gate carry information from superficial layer and deep layer respectively [2]. So, the gate start time and gate width are considered as important parameters in time gating strategy. We found the gates around DTOF peak have highest coherence parameter (β) with lower standard deviation in β and Brownian diffuse sufficient (〖αD〗 B) which refers to dynamics of scatterers. So, the time gates around DTOF peak were considered for gate positioning. Here, it has been suggested that the gate width is a parameter depending on broadness of instrument response function (IRF) and DTOF and can be calculated by difference between Variance (V) of DTOF and IRF [3]. In this study first, we characterized the system using a two-layer phantom with different dynamics of scatterers in bottom layer and validated the gate positioning and gate width at various source detector separations (SDS). Then, we evaluated the influence of SDS in td-DCS to detect brain physiologic hemodynamics responses during Hyperventillation (HV). Importantly, HV have been suggested to induce a global response and known to

change blood flow in both extra-cerebral and brain tissues, albeit not necessarily by the same amount [4]. However, interpretation of the task responses is complicated by the fact HV tasks generally induce global tissue responses, which might be expected to affect both the scalp/skull and the cerebral hemodynamics. We mean that the cerebral and the extra-cerebral (scalp/skull) tissues should both exhibit hemodynamic variations in response to the breathing tasks, although the magnitude of the flow variation across tissue types might be different. In hyperventilation task which causes hypocapnia, the blood flow decreases due to vasoconstriction.

We were able to see BFI reduction in all SDS but not with the same magnitude. According to system characterization using phantom measurements, short and large SDS are more sensitive to superficial and deep layer respectively. Lower decrease in BFI at longer SDS shows BFI changes during HV is higher in skin than deep tissue which was also approved by other optical methods [5]. So, by selecting photons at later time gate measured at long SDS, mostly the BFI response from deep tissues can be detected.

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Are the mechanisms of multidimensional apathy transdiagnostic in psychiatry? An electrophysiological study

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Apathy is a disabling symptom prevalent both in neuropsychiatric pathologies and in the healthy population1. Studies in neurology support the existence of three forms of apathy (executive, emotional, initiative) but the knowledge of the mechanisms is still limited2. In a previous work with healthy subjects3, executive and emotional apathy were associated to a deficit in using contextual information to guide behavior and an emotional blunting, respectively. The aim of the present study is to examine if these mechanisms underlying apathy are transdiagnostic across psychiatric disorders.
31 subjects were recruited: 14 healthy controls (HC), 17 apathetic patients with depression (MD) or schizophrenia (SZ). They completed the Dot-Pattern Expectancy (DPX) task4 and the Monetary Incentive Delay (MID) task5, combined with an electrophysiological recording.
The multiple regression model best fitted to the executive apathy showed that higher executive score was significantly associated with a more positive P3a for AX trials (DPX). The ANCOVA revealed no effect of the group ($p<.15$). The regression model best fitted to the emotional apathy showed that higher emotional score was significantly associated to a less negative CNV after reward cues (MID). The ANCOVA revealed that the group had a main effect ($p<.03$), with less negative CNV amplitude after a reward cue for the SZ than the MD and HC groups ($p<.02$).
These preliminary results could suggest a transdiagnostic mechanism for executive apathy, with an impaired context-sensitive cognitive control. However, the mechanism underlying emotional apathy could be diagnostic-specific, with a lack of reward anticipation only in SZ.

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Multi-level reorganization in the temporal dynamics of sound processing in early blind people

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Early blindness triggers reorganization in the brain networks that code for sound processing. However, how visual deprivation impacts the temporal dynamics of different stages of auditory discrimination (acoustic to categorical coding) remains mostly unexplored. We characterized the time course of brain activity using electroencephalography (EEG) while congenitally blind and sighted individuals listened to 1-second-long sounds belonging to eight categories. Multivariate decoding analyses revealed enhanced sound decoding in the brain of the blind compared to sighted from 200 to 1200 ms after sound onset. Furthermore, the classifier weights transformed and projected on the sensors were enhanced in the blinds with the topography evolving along a frontal-posterior axis as the sound unfolded in time. To investigate which stages of sound processing were enhanced in the blind, we used representational similarity analysis (RSA) with different models of sound representation: (i) the Modulation Transfer Function (MTF) to simulate early stages of acoustic processing, (ii) layers of a deep neural network (YAMNET), (iii) a high-level model based on the categorical membership of sounds. RSA with MTF displayed no differences between the two populations, while correlations with the DNN layers showed distinctions at 200 ms specifically in layers representing intermediate acoustic processing. While categorical representation of sounds emerged at 250 ms in both populations, only blinds showed an enhanced categorical representation peaking at 550 ms. These results suggest that early blindness triggers a multi-level reorganization in brain networks coding for sounds, with enhanced intermediate-level acoustic discrimination earlier in time, followed by an increased categorical coding later.

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Do intrinsic functional networks reflect interacting brain rhythms? Assessing the power bias in MEG amplitude connectivity at rest

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