SALZBURG MIND BRAIN ANNUAL MEETING 2022

The Centre for Cognitive Neuroscience (CCNS) at the University of Salzburg

presents

the 5th Salzburg Mind – Brain Annual Meeting, SAMBA 2022

Local organizing committee

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PROGRAM

SALZBURG MIND BRAIN ANNUAL MEETING 2022

Time	July 14	Time	July 15
08:15	Registration & Coffee		
08:40	Opening Remarks		
09:00	Talk 1: Freek van Ede Tracking internal attention through the eyes: what we have learned so far	09:00	Talk 6: Leonie Koban Social influences on emotion and decision-making
10:00	Coffee	10:00	Coffee
10:30	Talk 2: Andreas Keil Learning in the visual brain: Generalization versus sharpening	10:30	Talk 7: Christopher Summerfield Learning and generalisation of task knowledge in humans and neural networks
11:30	Short Break	11:30	Short Break
11:45	Talk 3: Martin Hebart Core representational dimensions of visually-perceived objects	11:45	Talk 8: Jonas Obleser Listening and meta-listening: How do direct and indirect paths shape auditory perception?
12:45	Lunch Break	12:45	Lunch Break
14:15	Talk 4: Anne Urai Choice history bias as a window into cognition and neural circuits	14:15	Talk 9: Tzvetan Popov How do alpha oscillations move your eyes about?
15:15	Coffee & Posters	15:15	Coffee & Posters
17:15	Talk 5: Liuba Papeo Relation perception and the social function of vision	17:15	Talk 10: Sonja Kotz Heard but not present: Pathophysiology of prediction and adaptation
		18:15	Closing Remarks & Poster Awards
		19:00	Social Event

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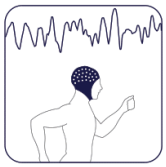
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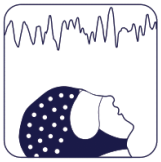
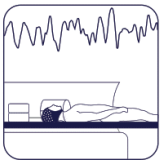
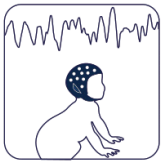
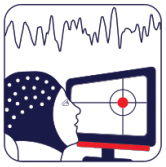
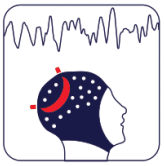

Sleep


EEG & fMRI


Developmental EEG


EEG §
Eye Tracking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TALKS

Talk 1:

Tracking internal attention through the eyes: What we have learned so far

Freek van Ede

VU Amsterdam

Selective attention can be directed not only to external sensations, but also to internal representations held within the spatial lay-out of working memory. We have recently uncovered how such internally directed selective attention is associated with directional biases in small eye movements known as microsaccades – extending the role of the oculomotor system to *internal* orienting of visual attention. In my talk, I will highlight this finding and show how we have started to utilise directional biases in microsaccades as a novel approach for tracking internal attention along three dimensions: to track (1) *whether* internal attention is deployed, (2) *when* it is deployed, and (3) *where* it is deployed. Doing so, I will illustrate how the study of microsaccades can be used to uncover new insights into the principles and mechanisms of internally directed selective visual attention in dynamic and immersive settings. I will finally address how such directional biases in microsaccade relate to neural modulation by covert spatial attention, arguing for a functional but not obligatory link between ocular and neural signatures of covert spatial attention.

Talk 2:

Learning in the visual brain: Generalization versus sharpening

Andreas Keil

University of Florida

Processing capabilities for many low-level visual features are experientially malleable, aiding sighted organisms in adapting to dynamic environments. In this presentation, we discuss how visuocortical responses change as human observers learned to associate exemplars drawn from a given feature dimension with aversive outcomes. Using classical aversive conditioning while recording dense-array EEG and pupillometry, we tested the pre-registered hypotheses of either sharpening or generalization for a range of feature dimensions, including orientation, motion direction, object category, and spatial location. Models of gaussian (generalization) or difference-of-gaussian (sharpening) changes after, compared to pre-conditioning were directly compared in a Bayesian framework. We found that visuocortical responses were selectively heightened when viewing aversively paired features for all feature dimensions. In the case of orientation, motion direction, and spatial location, effects displayed a non-linear, difference-of-gaussian profile across neighboring exemplars on a feature gradient, consistent with suppressive surround modulation of non-prioritized features. Measures of alpha band (8 – 12.8 Hz) activity and pupil diameter showed evidence of generalization. These results indicate that aversive conditioning of low-level visual prompts sharpened tuning in visual cortex. By contrast, aversive conditioning of higher-level features such as object category prompts linearly graded (generalization) modulation in visual cortex. These effects mirror the effects seen for top-down influences indexed by alpha power reduction and autonomic responses, also showing generalization. We summarize these changes in a computational model of adaptive population tuning as a function of experience.

Talk 3:

Core representational dimensions of visually-perceived objects

Martin Hebart

Max Planck Institute for Human Cognitive and Brain Sciences

Visual perception of our world seems incredibly easy. Yet despite tremendous progress in the field of vision science and recent breakthroughs in artificial intelligence, we still do not know how our visual system allows us to make sense of our world. One reason for this gap in knowledge may lie in the strong focus on trying to understand how our visual system allows us to recognize and categorize objects. Effectively, this approach equates vision with assigning labels to the things surrounding us. In this talk, I will argue that, instead, we should aim much broader at understanding the representational dimensions underlying our ability to make sense of our world. In my talk, I will highlight recent efforts from our group at identifying the core dimensions of visually-perceived objects and how they relate to object coding in the human brain. The results of our work paint a different picture to the traditional view of a hierarchy of the visual system, identifying behaviorally-relevant representations at even the earliest processing stages and indicating that a major organizational principle of the visual system is our ability to reason, communicate, and interact effectively with the visual world.

Talk 4:

Choice history bias as a window into cognition and neural circuits

Anne Urai

Leiden University

Perceptual choices not only depend on the current sensory input, but also on the behavioral context, such as the history of one's own choices. Yet, it remains unknown how such history signals shape the dynamics of later decision formation. In models of decision formation, it is commonly assumed that choice history shifts the starting point of accumulation towards the bound reflecting the previous choice. I will present results that challenge this idea. By fitting bounded-accumulation decision models to behavioral data from perceptual choice tasks, we estimated bias parameters that depended on observers' previous choices. Across multiple animal species, task protocols and sensory modalities, individual history biases in overt behavior were consistently explained by a history-dependent change in the evidence accumulation, rather than in its starting point. Choice history signals thus seem to bias the interpretation of current sensory input, akin to shifting endogenous attention towards (or away from) the previously selected interpretation. MEG data further pinpoint a neural source of these biases in parietal gamma-band oscillations, providing a starting point for linking across species.

Talk 5:

Relation perception and the social function of vision

Liuba Papeo

CNRS

Vision supports important aspects of social life. First, highly specialized visual mechanisms have evolved to process faces and bodies, conspecifics and other animals. But social life is made up of social entities as much as the relationships between these entities. The core social content is in fact relational. In a series of behavioral and neuroimaging studies, we show that perception is specialized for *seeing* socially relevant relationships. The results illustrate how the representation of social interaction emerges from object perception, through the analysis of the spatial relationships between multiple faces and bodies in visual scenes. Thus, visual perceptual mechanisms - and a network of visual brain areas - can give rise to the first rudimentary representation of social interaction based on the mere physical structure of input, before inferential processes kick in.

Talk 6:

Social influences on emotion and decision-making

Leonie Koban

Paris Brain Institute

Human behavior and experience are strongly influenced by social factors. What are the brain systems that mediate social influence effects on behavior? How do effects of social instructions differ from, and interact with, the effects of experience-based learning? I will present findings from behavioral and fMRI studies that show how pain, affect, and food craving is altered by social information, and how evaluative social feedback impacts self-perception and feelings about the self—in healthy and socially anxious individuals. Together, these different studies point at a role of frontoparietal brain areas, which may mediate how humans weight information in order to adjust behavior and affective experiences to their social context.

Talk 7:

Learning and generalisation of task knowledge in humans and neural networks

Christopher Summerfield

University of Oxford

There has been a renaissance of interest in connectionist networks as models of biological computation. During sensory perception, deep neural networks learn representations that resemble those in primate neocortex. However, neural networks learn to perform and generalise cognitive tasks in very different ways to people. In my talk, I will explore these differences, and suggest computational adaptations that allow neural networks to learn multiple tasks in series, reconfigure task knowledge from limited data, and generalise knowledge between tasks.

Talk 8:

Listening and meta-listening: How do direct and indirect paths shape auditory perception?

Jonas Obleser

University of Lübeck

Amidst a flurry of methodological advances in neuroimaging and data analysis, we have made somewhat limited progress in explaining individual (i.e., trait-like) and momentary (i.e., state-like) differences in a listener's sensations and perceptions, that is, in their behavioural outcome.

In the present talk, I will present recent evidence on two broadly distinct ways of how brain traits and states could shape the outcome of auditory perception: "direct" changes in sensory encoding specifically are contrasted with "indirect", modulatory or meta-cognitive changes along an auditory-perception cascade.

I will argue that more in-depth consideration of the latter, indirect class of neural processes will help us explain better audition as a whole, with implications for ageing, hearing loss, and aberrant perception.

Talk 9:

How do alpha oscillations move your eyes about?

Tzvetan Popov

University of Zurich

Solutions to core survival requirements are scaled, preserved, and present in nearly all creatures equipped with the ability to move. In this talk, a fundamental principle-emergence of behavior through rhythm mediated action is discussed, and examples of how neuronal rhythms monitor sensory action across phyla are highlighted (honey bee, non-human primates, and humans). The brain's active sensing of the surrounding environment entails clustering of eye/antenna movements towards an object or location. This active sensing behavior coincides with the amplitude modulation of a dominant (alpha) rhythm. Independent of testing conditions (e.g. light or full darkness) and cognitive load (e.g. rest, spatial attention, working memory), space is inferred by the movement direction of the brain's sensors manifesting in location-specific place topographies. These observations are discussed in light of the conjecture that the dominant rhythm of the brain facilitates and monitors sensorimotor output as a prerequisite for a proactive processing chain in cognition beginning with action. It is speculated that this principle is not exclusive to neuronal collectives. Instead, it is preserved across organizational scales, evident also in fish and bird collectives. A taxa-overarching principle enabling neural and animal collectives alike to interact with the environment and adapt behavior.

Talk 10:

Heard but not present: Pathophysiology of prediction and adaptation

Sonja Kotz

Maastricht University

In a continuously changing environment, we rely on prior knowledge to evaluate actual against expected sensations (predictions) and adapt to mismatches between these sensations. Pathological changes in the auditory system (e.g., deafferentation in tinnitus, aberrant sensory feedback in auditory verbal hallucinations) might lead to new default predictions that show as altered suppression and/or enhancing irrelevant sound. I will present animal and human studies on tinnitus and auditory hallucinations as examples of adaptive distortions in tone and voice processing. These data showcase the critical contribution of cortico-cerebello-thalamo-cortical circuitry in maintaining and adjusting predictions.

POSTER ABSTRACTS

1 How do alpha oscillations move your eyes about?

Tzvetan Popov[1]
[1]University of Zurich, Switzerland

Solutions to core survival requirements such as attention are scaled, preserved, and present in nearly all creatures equipped with the ability to move. In this talk, a fundamental principle of neuronal rhythms (alpha oscillations) in monitoring sensory action across phyla is discussed (honey bee, non-human primates, and humans). The brain's active sensing of the surrounding environment entails clustering of ocular/antenna movements towards an object or location. This active sensing behavior is monitored by the phase and amplitude of spontaneous (alpha) rhythm. Independent of testing conditions (e.g. light or full darkness) and cognitive load (e.g. rest, spatial attention, working memory), space is inferred by the movement direction of the brain's sensors manifesting in location-specific place topographies. These observations are discussed in light of the conjecture that the dominant rhythm of the brain facilitates and monitors sensorimotor output as a prerequisite for a proactive processing chain in cognition beginning with action.

2 Is number represented independently from other quantities in the human brain?

Alireza Karami[1], Manuela Piazza[1]
[1]University of Trento, Italy

The ability to estimate the number of items in a set (numerosity) without counting has been linked to a network of areas in the frontal and parietal cortices in the human brain. However, because numerosity is often correlated with other quantitative features of the sets (e.g., more items tend to occupy a larger area), it is a matter of debate whether numerosity is encoded as a primary visual feature or whether it is computed by combining different non-numeric features (e.g., total occupied area divided by item size). While significant behavioral results argue in favor of the first hypothesis, current neuroimaging data remain inconclusive in this respect. Here, we use fMRI and MEG to test whether, where, when, and to what extent number is represented independently from other visual features in the human brain.

While undergoing MRI and MEG, thirty human adult subjects attended to the number of dots that orthogonally varied in number, average item size, and total field area. We modeled the independent contributions of number and non-numeric features using multiple regression RSA of the MRI and MEG signals.

Regions of interest and whole-brain searchlight RSA convergently revealed that variance in brain activation patterns is significantly explained by number over non-numerical dimensions in several regions, especially along the dorsal visual stream. Furthermore, time-resolved RSA showed that early time points of the MEG are significantly explained by number. The following step of my research is to fuse MEG with fMRI to produce the spatio-temporal neural dynamics underpinning numerosity representation.

3 Resting-state electroencephalographic correlates of cognitive reserve: Moderating the age-related decline in cognitive function

Diego Pinal[1], Adriana Sampaio[1], Ana Buján[1]
[1]University of Minho, Braga, Portugal

We carried out an exploratory analysis of current source density (CSD) and lagged-linear connectivity (LLC) as resting-state electroencephalographic (rsEEG) correlates of cognitive reserve. Following a lifespan perspective, we first explored the relationship between rsEEG measures for different frequency bands and a socio-behavioral proxy of cognitive reserve, the Cognitive Reserve Index (CRI). Moderate negative correlations were found between the CRI and occipital CSD of delta (2 - 4 Hz) and beta 2 (21 - 30 Hz). Moreover, inter and intra-hemispheric LLC measures were correlated with the CRI, showing a negative association with delta, and positive associations with alpha 1 (8 - 10 Hz), beta 1 (13.5 - 20.5 Hz), and beta 2. Second, we applied moderation analyses to assess if any of the correlated rsEEG measures showed a moderating role on the relationship between age and cognitive function. Only two rsEEG variables were significant moderators of the relationship between age and cognition: occipital delta CSD and right hemispheric beta 2 LLC between occipital and limbic regions. The effect of age on cognitive performance was stronger for higher values of both measures. Therefore, lower values of occipital delta CSD and lower beta 2 LLC between right occipital and limbic regions might have neuroprotective effects on cognition during the aging process. If confirmed by future work, these results might be useful to allocate more preventive efforts to curb the progression of cognitive decline on those adults with less CR, possibly characterized by these rsEEG parameters at a neural level.

4 Spatial Similarities between Human Eye Movements and Deep Convolutional Neural Network Saliency Maps across Time

Leonard Elia van Dyck[1], Sebastian Jochen Denzler[1], Charlotte Paulina Schöllkopf[1], Walter Roland Gruber[1]

[1]University of Salzburg, Austria

In recent years, a growing interest in the similarity between the brain's ventral visual pathway and deep convolutional neural networks (DCNNs) during visual processing led to numerous findings based on electrophysiological data. These studies revealed striking temporal and spatial alignment between the biological and artificial cascades. To date, however, only few attempts have been made to investigate the temporal similarity from the standpoint of spatial priorities during information processing. Therefore, in this study, we aim to test the existing evidence in the realm of eye tracking and compare object recognition in human observers and DCNNs through eye tracking heatmaps and GradCAM saliency maps. We investigate the reproducibility of the temporal correlations reported in neural activity by analyzing eye movements only. Moreover, we consider explanations regarding bottom-up/feedforward and top-down/recurrent processing mechanisms as well as their impact on viewing-behavior during object recognition. Finally, in a data-driven approach, we use the recorded eye tracking heatmaps to create modified image datasets for fine-tuning DCNNs and thereby influence the human-likeness of the models directly.

5 Speech rhythm is modulated by amplitude, pitch, duration, and the spectral centre of gravity

Katerina Danae Kandylaki[1]
[1]Maastricht University, Netherlands

Both music and speech can be characterized by different degrees of rhythmic regularity. Acoustic features and their combination, such as pitch, duration, and loudness, define rhythmic regularity, and algorithms used in music information retrieval (MIR) allow quantifying them. Here we applied MIR-inspired methods of rhythm quantification in naturalistic speech excerpts (poems and stories) to tests if this method also applies to quantifying different degrees of rhythm regularity in speech. Second, participants evaluated rhythmic regularity of both speech types behaviourally. We expected that the beat-relevant features of pitch (F0), duration (Spectral Flux), and loudness (RMS energy) as well as their theoretically motivated combination (Theobeat) would differ significantly between poems and stories; however, non-beat-relevant features such as Spectral Centroid and Spectral Flatness should not reveal differences between the two speech types. MIR-based analyses allowed to successfully analyse rhythmic regularity in both speech types. While the computational results overall confirmed the expected patterns of results, the Spectral Centroid also differed between poems and stories. On the other hand, behavioural ratings of rhythmic regularity did not differ for poems and stories. These results confirm that beat-related features, but also some non-beat related features contribute to the physical realization of rhythmic regularity in naturalistic speech.

6 Violating internalized rules affects prediction processes in musicians

Thomas Hartmann[1], Gianpaolo Demarchi[1], Nathan Weisz[1,2]
[1]University of Salzburg, Austria, [2]Salzburger Landeskliniken, Austria

Music is not a random sequence of tones but follows a complex set of rules. Most people implicitly learn and internalize these rules from the moment they are born, enabling them, for instance, to predict how a melody is going to end. People who undergo musical training learn these rules explicitly, internalize them more, and also learn a greater amount of rules. In general, there are two known behavioral consequences: 1. better error detection for violations of pitch and rhythm, and 2. better predictions, how a melody continues. Previous attempts to study differences of cortical prediction processes between musicians and non-musicians have used the Mismatch-Negativity approach. Although differences were found, this approach only provides insight into the prediction error. Our study uses a more direct approach towards studying prediction processes in the cortex and their dependence on musical sophistication. Participants listened to a sequence of four tones. The order of these tones was either random, providing no opportunity for the brain to create predictions, or ascending, creating strong predictions. Additionally, the tones either created a perfect A-major chord or each neighboring interval was slightly detuned. Leveraging the predictive coding framework, we used Multivariate-Pattern-Analysis to assess how similar cortical activity was during the prediction and the perception interval. Our results show that this similarity is lower in individuals with high musical sophistication only in the detuned condition. We speculate that the higher sensitivity to out-of-tune tones brought about by musical training might disturb prediction processes in musicians but not in non-musicians.

7 Distinct beta frequencies reflect contextually-defined categories

Elie Rassi[1]
[1]Radboud University Nijmegen, Netherlands

Beta oscillations are involved in a variety of cognitive functions beyond their traditional sensorimotor role. Based on prior findings of content-specific beta synchronization during working memory and decision making, we hypothesized that beta activity supports the activation and reactivation of cortical representations by mediating neural ensemble formation within and between brain regions. We here found that beta activity in monkey dorsolateral prefrontal cortex (dlPFC) and in pre-supplementary motor area (preSMA) reflected the content of a stimulus in relation to the task context, regardless of its objective properties. In multiple versions of a categorization task, we changed a categorical boundary between sessions, such that a stimulus which belonged to one of two categories during one session could belong to the other category during the next session. During a delay in which monkeys had to hold their categorical decision in mind, we found that two distinct beta-band frequencies were consistently associated with the same two relative categories, and that activity in these respective bands predicted the animals' responses. We characterized beta at these frequencies as transient bursts with distinct temporal profiles. We further showed that dlPFC and preSMA were connected via these distinct frequency channels, with dlPFC driving the frequency separation, a result supported by granger causality and spike-field coherence analyses. In sum, these results provide support for the role of beta in forming neural ensembles, and further show that such ensembles might synchronize at different beta frequencies.

8 Modulating somatosensory alpha oscillations using high-density tACS

Vaishali Balaji[1], Joachim Lange[1]
[1]Heinrich Heine University Düsseldorf, Germany

Applying transcranial Alternating Current Stimulation (tACS) to the scalp entrains endogenous neuronal oscillations in a frequency-specific manner. However, it remains elusive whether tACS can induce changes that persist beyond the stimulation period and what mechanisms govern this effect. It is plausible that the tACS effects reported in recent studies had a transcutaneous (rather than transcranial) origin. Therefore, we aimed to elicit aftereffects of tACS in healthy participants on controlling for peripheral nerve stimulation. To this end, we applied a topical anaesthetic to the scalp and stimulated the right primary somatosensory cortex using a high-density ring electrode montage. During simultaneous acquisition of MEG, we administered tACS at a frequency of 10Hz in an intermittent on/off pattern for a duration of 10 or 30 seconds. Changes in alpha power between two trains of tACS and after tACS were compared to baseline and against sham. The results show that duration of stimulation might be a key parameter that modulates the emergence of sustained aftereffects. These findings inform the design and implementation of stimulation protocols aimed at inducing prolonged changes in electrophysiological activity of the human brain.

9 How does pre stimulus alpha phase shapes our perceptual integration window?

Michelle Johannknecht[1], Joachim Lange[1]
[1]Heinrich Heine University Düsseldorf, Germany

Prestimulus ongoing neuronal oscillations have been proposed to influence perception. One prominent, but controversially discussed, hypothesis is that cycles of neuronal oscillations shape temporal integration windows for multiple stimuli. If this is true than the phase of neuronal oscillations should be relevant for temporal perception. In this study, we tested this hypothesis by using a visual integration task with two visual stimuli. The task was to detect a blank spot in a 4 X 4 grid of annuli, which was possible only when the two stimuli were successfully integrated over time. We varied the stimulus offset asynchrony between the two visual stimuli, focusing on the offset where participant's performance was around 50 % accuracy. We recoded the MEG signal and analysed the phase of the ongoing neuronal oscillation between 2 to 30 Hz on source level. We identified clusters in the occipital and parietal cortex were the phase angles significantly differed between correctly and incorrectly temporally integrated trials. Those clusters had different frequency ranges, showing peaks in the alpha and beta range. We conclude that ongoing neuronal oscillations shape temporal integration windows.

10 Maternal Influences on the Cognitive Development of Toddlers

Jasmin Preiß[1], Adelheid Lang[2], Theresa Hauser[1], Monika Angerer[1], Manuel Schabus[1]

[1]University of Salzburg, Austria, [2]Paracelsus Medical University, Salzburg, Austria

Introduction: Children's social, cognitive and emotional development is thought to be heavily influenced by early mother-infant interaction. These interactions are not only shaped by child and contextual factors but also by maternal personality and well-being.

Methods: In a sample of 42 mothers and their toddlers (16-32 months of age) we evaluated children's cognitive development with the Bayley Scales. Maternal personality traits were assessed with the Big-Five Inventory-10. The Toddler CARE-Index was used to assess dyadic mother-child patterns as well as interaction quality. To assess the relationship between cognitive development, maternal personality and dyadic interaction behaviour, non-parametric correlations were conducted.

Results: We found higher maternal agreeableness to be associated with better cognitive development (r_s = .39, p = .010). While interaction quality was not linked to toddler's performance (r_s = -.09, p = .553), children's display of compulsive behaviour in the dyadic interaction was correlated with better cognitive development (r_s = .34, p = .026).

Conclusion: Toddler's greater cognitive performance was associated with maternal agreeableness, a personality trait linked to kindness, warmth and emotional support of others, suggesting the developmental benefit of a supporting environment. The finding of better cognitive skills in compulsive children may suggest that these children might outperform their peers as they already learned to fulfil the caregiver's needs and expectations. Based on these findings, young children's superior cognitive development can be attributed to a supportive environment as well as to children's adaptive strategies to environments that request rather compulsive behaviours already early in life.

11 The influence of electric brain stimulation (tACS and tRNS) over the articulatory motor cortex on cortical excitability and categorical perception of speech sounds

Jessica Jacobs[1], Alexis Hervais-Adelman[1], René Müri[2], Dario Cazzoli[3], Basil Preisig[1]

[1]University of Zurich, Switzerland, [2]University Hospital of Bern, Switzerland, [3]Luzerner Kantonsspital, Lucerne, Switzerland

Although the ventral motor cortex (vMC), the area where the neural representations of the articulators are located, is activated during speech perception, its functional role remains unclear. Previous studies reported that the inhibition of this region with repetitive transcranial magnetic stimulation (rTMS) impaired categorical speech sound perception. Moreover, listening to speech sounds has been shown to facilitate cortical excitability in this region. We hypothesized that enhancing cortical excitability in this area would increase categorical speech sound perception. In two experiments, different forms of non-invasive electric brain stimulation (kHz transcranial alternating current stimulation and transcranial random noise stimulation) were probed to enhance cortical excitability in the vMC. The excitability was assessed, before and after electric stimulation, by measuring the amplitude of motor evoked potentials (MEPs) elicited by monophasic single pulse TMS. The MEPs were recorded on the lip muscle orbicularis oris (OO). Categorical perception of speech sound was assessed by a syllable identification and discrimination task. The analysis of the neurophysiological data revealed no significant enhancement of cortical excitability after electric brain stimulation. Further, electric stimulation in both experiments did not modulate syllable identification and discrimination performance. Thus, no significant change in categorical speech sound perception could be observed. Nevertheless, we found a positive correlation between the relative changes in the amplitude of the MEP's and the relative changes in speech sound categorization. Participants, who showed an increased motor evoked response after transcranial random noise stimulation, also showed increased syllable discrimination performance.

12 Electrophysiological hallmarks for event relations and event roles in working memory

Xinchi Yu[1], Jialu Li[2,3,4], Hao Zhu[2,3,4], Xing Tian[2,3,4], Ellen Lau[1]

[1]University of Maryland, College Park, University System of Maryland, United States, [2]New York University Shanghai, New York University, China, [3]East China Normal University, Shanghai, China, [4]NYU-ECNU Institute of Brain and Cognitive Science at NYU Shanghai, China

The ability to maintain events (i.e. interactions between/among objects; e.g., a lion hit an elephant) in working memory is crucial for our everyday cognition, yet the format of this representation is poorly understood. Two critical components of event representation are event relations (hitting in this example) and event roles (agent and patient, i.e. the initiator and the receiver of the event), while it remains elusive how they are represented in working memory. For event relations, an outstanding question is whether they take up discrete working memory slots as individual objects do (Shen et al., 2021).

In order to explore this question, in the current study we set out to identify the ERP hallmarks for event relations and event roles. We designed a picture-sentence matching study with a novel "pinging" manipulation (Wolff et al., 2017). Half of the pictures depicted events (e.g., a lion hit an elephant, Hultén et al., 2014) and the other half depicted coordinations (e.g., a lion and an elephant). We identified a sustained posterior-occipital ERP difference between these two conditions. This effect resembled the negative slow wave (NSW) driven by the number of objects maintained in working memory within the discrete ~4 working memory capacity (Feldmann-Wüstefeld, 2021), leaving open the possibility that event relations also take up discrete working memory slots. On the other hand, by employing "pings" (animal names in larger font) for the agent and patient animals respectively during the retention period, we exploratorily identified a late occipital difference after ping onset hallmarking event roles.

13 Neural plasticity in the reading network

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The reading network in the human brain comprises several regions, including the left inferior frontal cortex (IFC), ventral occipito-temporal cortex (vOTC) and dorsal temporo-parietal cortex (TPC). The left TPC is crucial for phonological decoding, i.e., for learning and retaining sound-letter mappings, and shows marked hypoactivation in dyslexics. Here, we tested the causal contribution of this area for reading with transcranial magnetic stimulation (rTMS) and explored the reading network's response using fMRI. In two independent studies, subjects received either inhibitory or sham (placebo) stimulation (N=28; healthy adults), or facilitatory or sham stimulation (N=27; adults with dyslexia) over the left TPC before performing an overt word and pseudoword reading task. Behaviorally, effective as compared to sham stimulation led to slower reading of pseudowords in typical readers, and marginally faster reading across all stimuli types in dyslexics. On the neural level, we observed changes in task-related activity and connectivity for pseudowords in typical readers: effective TMS led to increased effective connectivity from the left vOTC to the left TPC as well as to a shift in activity patterns in the left frontal cortex. We interpret these as compensatory mechanisms following left TPC disruption. Preliminary uni- and multivariate analyses of the dyslexic group show that TMS led to changes in brain activation patterns for words and pseudowords in primarily right-hemispheric regions, including the right insula and the right intraparietal sulcus. Overall, we emphasize the importance of considering within-network interactions during reading and provide evidence for a critical role of the left TPC for reading.

14 Frequency-tagging the animate-inanimate visual object categorization in human adults

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Human adults effortlessly categorize visual objects, first distinguishing between animate and inanimate entities. Using frequency-tagging electroencephalography, we targeted a direct, robust and automatic signature of visual object categorization by animacy in the adult human brain, to study which are the visual features that primarily contribute to the automatic distinction between animate and inanimate objects. In Experiment 1, participants (N=12) viewed colored images of animate and inanimate objects at a rapid frequency (6 Hz). The categorization of animate objects was tested by showing a stream of inanimate objects, with an animate oddball every 5 images, yielding an oddball stimulation frequency of 1.2 Hz. The categorization of inanimate objects was tested by showing a stream of animate objects, with an inanimate oddball. In control conditions, the same images were presented but their phase was scrambled, maintaining low-visual properties such as color and luminance variations, but yielding unrecognizable images. In Experiment 2 (N=12), participants saw grayscale images. Phase-scrambled images were further replaced by texforms images that preserve texture and the global form of the original stimuli, but are no longer recognizable. Results highlighted a high signal-to-noise ratio at the oddball frequency and harmonics in both experiments for all conditions, with stronger and broader responses to recognizable images than to either phase-scrambled or texform images. These results suggest that both low- and mid-level features participate in yielding the visual categorization of animate and inanimate objects in the human adults' brain, although none of those visual features fully explain the observed fast categorization.

15 Action specific and cross-modal representations of emotional expressions – a multivariate pattern approach for mirror neurons in fMRI

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According to the embodied simulation theory (e.g., Gallese, 2007), mirror neurons (MN) present the neural basis for an automatic understanding of another person's emotional state. This automatic understanding is enabled by a shared neural representation for observed and performed actions. Multivariate pattern analysis of fMRI data provides a sensitive method to assess the key properties cross-modality and action specificity of MN in concert. 73 participants performed a social-cognitive task during two fMRI scanning sessions. For the second session, data of 32 participants of a TMS-sham group were assessed to evaluate reliability. Facial expressions of fear and anger were either observed, executed, or imitated. Cross-modal classification of emotional content was performed within participants in regions of interest (ROI) of the MN system and the emotional face processing system. Additionally, a whole-brain searchlight approach was employed. For significance testing, a permutation scheme was applied. Significant above chance accuracy was achieved in all ROIs for both time points when emotion classification was trained on the execution condition and tested on the imitation condition. For this analysis, the searchlight approach showed the highest classification accuracy in frontal and inferior temporal regions. Reliable cross-modal classification was not possible when the observation condition was included in the analyses. Our results only partially lend support to the embodied simulation theory. Reliable cross-modal classification was only possible when the execution of facial expressions was included in both modalities. Future studies could use facial expressions with negative and positive valence to ensure better differentiation between conditions.

16 Individual prediction tendencies facilitate cortical speech tracking

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Listening can be conceptualized as a process of active inference, in which the brain forms internal models to predict and integrate auditory information in a complex interaction of bottom-up and top-down processes. We propose that individuals vary in their ››prediction tendency‹‹ and that this variation contributes substantially to experiential differences in everyday listening situations and shapes the cortical processing of acoustic input such as speech. In the current study, we used a passive paradigm presenting tone sequences of varying entropy level, to independently quantify auditory prediction tendency (as the tendency to anticipate low-level acoustic features according to their contextual probability) for each individual. This measure was then used to predict the magnitude of cortical speech (envelope) tracking in a multi speaker listening task, where participants listened to audiobooks narrated by a target speaker in isolation or interfered by 1 or 2 distractors. Furthermore, rare semantic violations were introduced into the story, enabling us to also examine effects of word surprisal during continuous speech processing. Our results show that individual prediction tendency facilitates cortical speech tracking. Furthermore, we find interactions between individual prediction tendency and background noise as well as word surprisal in disparate brain regions. In sum, our findings suggest that individual prediction tendencies are generalizable across different listening situations and may serve as a valuable element to explain interindividual differences in natural listening experience.

17 The temporal response function delineates temporal evolution of neural speech tracking as speech intelligibility changes

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Listening to speech with poor signal quality is challenging. Neural speech tracking of degraded speech has been used to advance the understanding how brain processes and speech intelligibility relate, however the temporal dynamics of neural speech tracking is not clear. In the present MEG study, we thereby exploited temporal response functions (TRFs) and generated signal-degraded speech to depict the temporal evolution of speech intelligibility modulation on neural speech tracking. In addition, we used and inter-related other facets of neural speech tracking (e.g., speech envelope reconstruction, speech-brain coherence, and components of broadband coherence spectra) to support our findings in TRFs. Our TRF analysis yielded marked temporally differential effects of vocoding: while early peak responses (~50-110 ms, M50TRF) were massively increased, reduction of intelligibility went along with strongly reduced responses around 175-230 ms (M200TRF). For the late responses 315-380 ms (M350TRF), the maximum response occurred for degraded speech that was still comprehensible then declined with reduced intelligibility. Furthermore, we related the TRF components to our other neural measures and found that M50 and M200 play a differential role in the shifting center frequency of the broadband coherence spectra. Overall, our study highlights the importance of time-resolved computation and parametrization of coherence spectra on neural speech tracking and provides better understanding of degraded speech processing.

18 Tackling endogenous theta oscillations in primary auditory cortex

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Accumulating evidence shows that auditory cortex is tracking rhythmic fluctuations of the speech signal, often framed as entrainment. The underlying mechanism, resonance or entrainment, and its functional significance, however, are still unclear. Following Notbohm et al. (2016), who have investigated individual alpha peaks in the visual cortex, we created ~19 sec long, amplitude modulated sweeps accelerating from 3 to 8 Hz, hence, spanning across the commonly reported range of theta oscillations. While recording EEG, 20 participants listened to 60 repetitions of the sweep at two different levels of loudness (at 52dB SPL and 12dB below; 120 trials in total). This pure listening task was interrupted twice by a short behavioral auditory discrimination task. Additionally, we recorded 3 minutes of resting state EEG in silence and 3 minutes in white noise. In total, the experiment lasted for about 60 minutes. We quantified the normalized Shannon Entropy (Notbohm et al., 2016) and the phase-locking value (PLV; Duecker et al., 2021) between the envelope of the sweep and the EEG signal. Interestingly, we found a u-shaped function of Entropy in the theta range over auditory areas compared to an occipital control region, but not compared to rest. The PLV, however, exhibited a linear decrease with increasing frequency compared to rest and occipital regions. Both findings are contrary to the notion of resonance and entrainment that would predict amplified responses at certain preferred frequencies. In sum, our preliminary data suggest that there is no oscillatory behavior in the theta range in auditory cortex.

19 Neural complexity and spectral slope as robust non-linear electrophysiological markers of cognitive state and task performance

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Human brain activity changes between cognitive states and with different levels of cognitive demand. Recent evidence suggests that nonlinear activity in the human EEG, specifically the spectral slope and neural complexity, can distinguish wakefulness from sleep and anaesthesia and is even linked to behavioural task performance. Here, we utilized these markers to investigate whether they can also distinguish different cognitive tasks during wakefulness in addition to delineating sleep from wakefulness. We analysed full-night polysomnography from 28 male subjects (21.54 ± 1.90 years) on three occasions in a within-subjects design. Subjects performed multiple tasks, including a Go/Nogo task, declarative learning task and resting sessions (with open and closed eyes). We computed the Lempel-Ziv-Welch complexity and spectral slopes of EEG power spectra between 30-45Hz for each task and sleep stage. The performed cognitive tasks did not modulate neural complexity as only an open vs. closed eyes effect was observable. However, an increase in task demand led to a flattening of the spectral slope and the slope of the Go/Nogo task correlated positively with task performance. Both, spectral slope and neural complexity were modulated by sleep, showing decreasing complexity and steeper slopes with deeper sleep stages. Only the spectral slope was sensitive enough to distinguish REM from other sleep stages and wakefulness. Critically, all results were highly stable and emerged across three recordings per subject. Our findings suggest that neural complexity and spectral slope can serve as informative, easily accessible and intra-individually robust markers of cognitive demand and altered brain states.

20 Not in Control After All - Reasons Why Attentional Control Unlikely Predicts Differential Cognitive Processing in Video Gamers

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Video gaming might alter cognitive processing given that video gamers outperformed control individuals in paradigms demanding differential cognitive functions. Hereby, video games might elicit transfer effects by training a cognitive function which several cognitive processes relay on. Attentional control, the ability to suppress distractors while processing relevant information, may be a promising candidate here. We investigated this by conducting two studies applying either electroencephalography (EEG) or transcranial alternating current stimulation (tACS) and computational modeling based on the theory of visual attention (TVA). In both studies, individuals performed a short-term memory paradigm where white shapes presented either in the left or right hemifield, either with our without distractors at one of three different exposure durations were to be memorized. Attentional control, spatial attention, memory and processing speed were modeled from individuals' performance differences in response to differential memory display conditions. Moreover, we operationalized attentional control using EEG alpha amplitude modulation. We expected video gamers to exhibit superior TVA and EEG attentional control than control individuals, and that this might predict differences in additional cognitive functions. Furthermore, we tried to induce differential cognitive processing as observed in video gamers by applying tACS at alpha frequency. Video gamers demonstrated superior processing speeds than control individuals, but similar attentional control. In contrast, control individuals displayed associations between visuospatial attention and TVA and EEG attentional control. The latter effect was replicated and modulated applying alpha tACS. Thus, our results do not support that attentional control represents a substrate of differential cognitive processing in video gamers.

22 Grouping two bodies in one relation: Intermodulation of frequency tagged face-to-face bodies

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People are often viewed among other people, relating to and interacting with one another. Recent studies suggest that spatial relations between people such as face-to-face, which cue social interaction, result in the grouping of multiple individuals in a perceptual unit. The current study investigates whether face-to-face individuals give rise to a new whole, by targeting an EEG correlate of the non-linear integration of the neural response to two bodies, which cannot be simply accounted for by the mere response to each individual (e.g., the sum). In a dual frequency-tagging EEG paradigm, participants (N=32) viewed couples of bodies, either face-to-face or back-to-back, flickering at two different frequencies (F1 and F2). Spectral analysis examined the intermodulation frequencies (±nF1±mF2), signaling non-linear integration of the two individual responses. An anterior intermodulation response was observed only for face-to-face bodies –but not for back-to-back bodies or face-to-face chairs and machines. These results show that face-to-face bodies are automatically integrated into a representation that is more than the sum of individuals bodies. This process may be the first step in the construction of the integrated representation of a social event, from the representation of individual bodies.

23 Early automatic response in primary auditory cortex favours looming sounds

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Our auditory sense allows us to constantly monitor our surroundings for potentially hazardous events such as looming objects. Researchers have studied the phenomenon of increased saliency of looming sounds by creating moving stimuli through changes in either broadband or spectral intensity, thereby eliciting looming bias across various species and ages during attentive listening. For effective hazard protection, however, the bias should not require the listener's attention. In our present study, we directly compared the two cue types used to elicit the looming bias and looked into the role of attention: twenty-eight normal-hearing listeners were initially passively exposed to the stimuli, being directed to focus on a muted, dubbed movie. Subsequently, they were asked to discriminate sound motion by keypress. In both conditions, neural activity was recorded through high-density electroencephalography. Cortical source activity was localized based on individual brain anatomies and electrode positions. Behaviourally, we verify the presence of the looming bias and its manifestation in higher accuracies for spectral cues and faster responses for broadband cues. Neurally, we see the emergence of the bias as early as 100 ms after the change. The bias is evoked later but stronger for changes in broadband versus spectral intensity and, most importantly, present in both passive and active listening modes. At the level of the primary auditory cortex (PAC), the bias occurs most consistently on the right hemisphere. Together, our findings of early pre-attentive biases in the PAC suggest a strong bottom-up directed prioritisation in the neural processing of looming sounds.

24 Processing of familiar vs. unfamiliar names in infants

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Introduction: Fetuses can discriminate their native language and their mother's voice and 4-month-olds can recognize their name and turn their head toward the voice calling them. However, most studies measured heart rate or behaviour, and not the brain activity during these processes.

Methods: High-density EEG was recorded from 13 infants (mean age = 596.5 days, SD = 186.6 days, female = 6). During the recording, the children listened to their own name in their mother's voice and in an unfamiliar voice, and to four unfamiliar names in an unfamiliar voice, two in the native language (German) and two in an unfamiliar language (Hungarian). After computing the event-related potentials, we defined specific time windows for an early negative peak (200-300ms) and a late positive peak (800-900ms).

Results: We found no significant differences when contrasting the voices or the names (familiar vs. unfamiliar). However, the contrast between familiar and unfamiliar language produced significant differences ($p<0.10$) during both time windows. The peak amplitude during the negative peak was more negative for the German names than for the Hungarian ones ($p = 0.0651$, $t = -2.03$), while during the positive peak it was more positive for the Hungarian names than the German ones ($p = 0.0985$, $t = -1.79$). The average voltages during both peaks behaved similarly.

Discussion: During the early time window, the lexical-semantic processing seems stronger for the familiar language. Nevertheless, the integration processes during the late time-window engage the neural cortex stronger for the unfamiliar language than for the native one.

25 Early categorization of social affordances during the visual encoding of bodily stimuli

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Interpersonal interactions rely on various communication channels, both verbal and non-verbal, through which information regarding one's intentions and emotions is transmitted. Here, we investigated the neural correlates underlying the visual processing of hand postures conveying social affordances (i.e., handshaking), compared to control stimuli such as hands performing non-social actions (i.e., grasping) or showing no movement at all. Combining univariate and multivariate analysis on electroencephalography (EEG) data, our results show that occipitotemporal electrodes show an early (200 ms after image presentation) differential processing of stimuli conveying social information compared to non-social ones. First, the amplitude of two Event-Related Potentials related to the perception of body parts (i.e., the N190 and the Early Posterior Negativity - EPN) is modulated differently during the perception of social and nonsocial content carried by hands. Moreover, our multivariate classification analysis (MultiVariate Pattern Analysis - MVPA) expanded the univariate results by revealing two crucial time windows for distinguishing implied motion with and without social affordances over occipito-parietal sites. In conclusion, we provide new evidence suggesting that the encoding of socially relevant hand gestures is categorized in the early stages of visual processing and future studies will need to clarify whether and how fronto-parietal networks contribute to structuring this functional organization in the visual system.

26 M1-P15 as a cortical marker for transcallosal inhibition: a preregistered TMS-EEG study

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The combination of transcranial magnetic stimulation and electroencephalography (TMS-EEG) is a powerful tool to investigate brain connectivity, allowing to trace the signal propagation from the stimulated area to effectively connected ones. However, current literature lacks a characterization of specific indexes of effective connectivity. Moreover, the technical challenges of TMS-EEG recordings together with the undisclosed analytic flexibility of multidimensional data jeopardize the reliability of findings in this field. Here, we aimed at validating M1-P15, a recently described cortical index of transcallosal communication between motor areas derived from TMS-evoked potentials, and at further investigating its behavioral relevance for bimanual coordination as well as possible task-dependent modulations. To increase methodological rigor and transparency, hypotheses and methods were preregistered on Open Science Framework before data collection. Thirty-two healthy participants underwent behavioral motor tasks and TMS-EEG recording, in which left and right primary motor cortices were stimulated both during bimanual tasks and during an ipsilateral silent period (iSP) paradigm. Our results replicated the significant relationship between M1-P15 and the iSP, while the link between M1-P15 latency and bimanual coordination was not confirmed. Furthermore, M1-P15 amplitude was modulated by the bimanual task, and not by the contralateral hand activity during the iSP paradigm. In sum, the present results corroborate our previous findings in validating the M1-P15 as a cortical marker of transcallosal inhibition and provide novel evidence of its task-dependent modulation. This work represents the first example of preregistration in the TMS-EEG field, paving the way for reproducible evidence in the understanding of brain effective connectivity.

27 Brain source correlates of speech perception and reading processes in children with and without reading difficulties

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Reading skills and speech perception have been studied extensively in the literature and their neural correlates have been shown to be associated with each other. However, their relationship remains debatable. In this study, we investigated reading skills, speech perception, early visual reading process, and their correlates with brain source activity in auditory and visual modalities. The analysis was conducted on 12–13-year-old school-age children (comprising poor and good readers), using high-density event-related potentials (ERPs), fixation-related potentials (FRPs), and the (CLARA) source reconstruction method. Auditory brain ERP source indices were computed from repeated Finnish speech stimuli presented in an auditory oddball paradigm. Visual brain FRP source indices were computed for words within sentences presented in a reading task. The results showed significant correlations between speech ERP sources and reading scores for the auditory P1 response in the left hemisphere and the auditory N250 response in both hemispheres, and a weaker correlation for visual word processing N170 FRP source(s) in the temporo-posterior occipital areas, in the vicinity of the visual word form areas (VWFA). Furthermore, significant brain-to-brain correlations were found between the two modalities, the speech P1 and N250 brain sources correlated with the reading N170 sources. Our results suggest that speech processes are linked to reading fluency performance and that brain activation to speech is linked to visual brain processes of reading highlighting a relationship between language and reading systems even after several years of exposure to print.

28 Lip movements enhance neural tracking in challenging listening situations

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Listening in natural environments is multisensory, and especially when more than one speaker is involved, successful listening can be challenging. Recently, neural tracking methods have shed light on speech processing using continuous auditory speech. The influence of visual features on neural tracking using audiovisual speech has not yet been shown. Due to the principle of inverse effectiveness, visual features should in principle enhance multisensory integration, especially in challenging listening situations. Here, we investigated the influence of lip movements on neural tracking as a putative correlate of multisensory integration. Using magnetoencephalographic (MEG) data from 29 participants listening to audiovisual speech with or without an additional auditory distractor stream, we investigated neural tracking of lip movements via forward encoding models in source space. When comparing prediction accuracies in a temporal region between the two conditions, they were higher when a single speaker was presented. When restricting the analysis to an occipital region, prediction accuracies were enhanced in the multi-speaker condition compared to the single-speaker condition. Crucially, when controlling for acoustic features and using an audiovisual region of interest, neural tracking is enhanced in the multispeaker condition when lip movements are added to the model. Our findings suggest that lip movements are supporting successful listening, especially in challenging situations. Furthermore, this work highlights the importance of using audiovisual stimuli to study neural tracking in a more natural way.

29 Post-call cognitive impairment in physicians: an fMRI study

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Sleep deprivation is associated with an impairment of cognitive functions and increased error rate in the work routine. The aim of this study was to examine whether there were measurable changes in the brain activity in physicians after a night shift compared to a normal shift and its relation to workload and sleep parameters in a real life setting.

Thirty-one physicians participated in two testing dates in the morning after sleep deprivation (SD) by post-call duty or in the morning after a normal shift (RW). On the testing date the participants were asked about demographic data, workload and the current sleepiness. By using fMRI each participant performed a two-back task and a zero-back task by means of a button box and underwent a resting state scan.

The fMRI data showed a significant interaction between n-back task and the sleeping conditions in the left frontal pol. At the two-back task SD participants had significant longer reaction times and more errors than RW. Default mode network, salience network and other functional connectivity parameters showed no significant difference in SD and RW. Furthermore, SD indicated increasing subjective burden, effort and the physicians described themselves sleepier.

This study showed that SD leads to reduced cognitive performance, increasing error rate and longer reaction times. In the fMRI results, participants with SD had higher brain activation in the left frontal pol for the two-back task compared to the zero-back task. The higher activation could reflect of a compensation mechanism caused by cognitive higher load.

30 Preliminary Results on the efficacy of a web-based treatment program for sleep disorders and insomnia.

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Background: There is a need for easily accessible, low-threshold, and effective treatment options to compensate for insufficient access to the treatment of sleep disorders and insomnia. In this study we aim at evaluating the efficacy of an CBT-I-based online-intervention by assessing sleep objectively via ambulatory Polysomnography (PSG).
Methods: Preliminary analysis involved thirty-one volunteers (mean age 43.1±13.3 years, 16 female) suffering from sleep problems. Participants were randomly allocated either to an intervention group (GSC, n= 13) or to an active control group (CG, n= 18). The GSC group participated in a 6-week online-program based on CBT-I concepts. In contrast, the online-program of the CG focused on elements that are known to promote healthy sleep rather than on therapy-specific components. Sleep was assessed both objectively, via ambulatory Polysomnography, as well as subjectively, via questionnaires at three time points (i.e., baseline, pre- and post- intervention). For subjective data, we added a follow-up evaluation one month after the intervention.
Results: Only the GSC-group showed substantial improvements in PSG-derived 'wake after sleep onset' (78.5 min to 38.5 min.; $p<.05$) and 'sleep efficiency' (from 81.3% to 90.1%; $p<.01$) from baseline to post-intervention. Regarding subjective sleep data, we found that in both groups insomnia symptoms (assessed via the Insomnia Severity Index) improved significantly from baseline to follow-up (GSC: 13.5 to 7.23; $p<.01$; CG: 12.8 to 10.6; $p<.05$).
Conclusion: The findings indicate the beneficial effect of low-threshold intervention programs for improving sleep not only subjectively but also objectively and thus enabling changes on the physiological level as well.

31 Eye-activity tracks prioritized auditory features in selective attention to natural speech in a multisensory multispeaker paradigm

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In order to succeed in challenging listening situations, the brain obtains information from multiple senses. Recent studies suggest interactions not only between visual and auditory areas but also show that sensorimotor integration is important to enhance attentional gain of prioritized information. Previous work has shown that eye-activity tracks higher hierarchical structures of speech stimuli with fixed underlying syntactical and rhythmical rules. Here, we extend these findings by showing that this tracking is modulated by attention within and across sensory modalities when listening to naturally spoken sentences. Using eye-tracking with simultaneous MEG-recordings, we provide evidence that ocular movements track the envelope of a single target speaker when attending to the auditory modality while ignoring visual input. This effect is not present when visual input is attended and auditory input is ignored. Crucially, eye-activity even shows stronger tracking of a target speaker over and above a simultaneously presented distractor speaker. This suggests that speech related eye-activity is not only modulated by attention across sensory modalities, but also within the auditory modality. We assume that the reported effects of speech tracking by eye-movements reflect a substantial role of the motor-system to prioritize features in the acoustic environment, especially as input becomes more complex and challenging. In sum, our findings suggest an 'epiphenomnistic' role of ocular activity as a 'readout' of relevant information during a phonological transformation process within sensorimotor integration.

32 Ketamine-Induced Dissociation Does Not Increase Fronto-Limbic Functional Connectivity in Individuals with Posttraumatic Stress Disorder

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Dissociation has been conceptualized as emotion overmodulation mediated by prefrontal inhibition of limbic regions. However, while observations of increased resting-state mPFC-amygdala functional connectivity in individuals with the dissociative subtype of posttraumatic stress disorder (PTSD) have supported this model, causal evidence is lacking. As dissociation can be elicited by intravenous infusion of subanesthetic ketamine (0.5 mg/kg) but not midazolam (0.045mg/kg), we used ketamine to pharmacologically manipulate dissociation and assessed effects on resting-state mPFC-amygdala functional connectivity in individuals with PTSD (N = 26). Contrary to our pre-registered predictions, ketamine did not promote a greater increase in mPFC-amygdala functional connectivity from baseline to infusion than midazolam. Instead, ketamine elicited a transient decrease of vmPFC-amygdala functional connectivity. Our findings challenge the emotion overmodulation model of dissociation and call for a more differentiated view on the neurobiological underpinning of dissociative phenomena in PTSD.

33 Sex hormones modulate sex differences and relate to hemispheric asymmetries in a divided visual field Navon task

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Sex differences in functional hemispheric asymmetries (FHA) have been hypothesized as a fundamental mechanism behind sex differences in global-local processing. So far, it has not been assessed how interactive effects of sex and hemifield presentation influence common indicators of global precedence. This study is the first to investigate the involvement of FHAs by using a divided visual field Navon paradigm and controlling for sex hormone status. 39 men and 39 naturally cycling women in their luteal cycle phase completed a divided visual field Navon task with the instruction to detect targets either at any level (divided attention) or only at the global or local level (selective attention) in three different spacing conditions. The obtained evidence reveals significant sex differences in the global advantage effect for densely spaced letter stimuli, as well as significant sex differences in global-local level interference, with findings on both measures being mediated by testosterone. Also, estradiol showed different relationships to the global advantage effect in men and women together with a positive relationship to global advantage for the selective attention condition. Behavioural reaction time results were mirrored by accuracy measures but presented significantly higher global- over local-level accuracy in women compared to men for the divided attention condition. Our results did not show significant sex differences in FHAs but indicate differential relationships between progesterone and FHAs in men and women. In conclusion, sex hormones emerged as central mediators of sex differences in global precedence and possible moderators of hemispheric asymmetries.

34 Lexical and semantic coding in the occipital cortex of congenitally blind adults.

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The visual cortex of Early Blind (EB) people engage in higher cognitive functions different from vision, such as language. However, it is unclear which linguistic feature is represented in the occipital cortex of the blind and whether the recruitment of this brain region depends on task demands. To address these questions, we recorded MEG brain activity of EB participants performing a lexical decision task and a semantic decision task on abstract and concrete spoken words. Multivariate pattern analysis of MEG data across all sensors showed significant decoding of lexical information (words vs. pseudowords) in the lexical task and semantic information (abstract vs. concrete) in both lexical and semantic tasks. Lexical and semantic information decoding showed comparable temporal profiles in EB as compared to a sighted control (SC) group. Crucially, however, projections of classifiers weights onto the cortical surface evidenced that, as compared to SC, occipital brain regions of EB showed greater contribution in the recognition of these classes of stimuli. Moreover, occipital responses in EB occurred in parallel to activations in frontotemporal semantic systems, suggesting that occipital activity contributed to semantic access. Overall, the present findings suggest that the occipital cortex of blind individuals enhance its response to lexical and semantic processing in a task-independent way.

35 The Neurogram – a quantification of real-life hearing impairments based on electrophysiology

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The current gold-standard for the diagnosis of hearing loss is pure-tone audiometry. Yet, the artificial pure tones used to assess hearing thresholds in pure-tone audiometry do not resemble real-life listening situations. Therefore pure-tone audiometry only provides an incomplete picture of individual hearing impairment, as disorders such as supra-threshold hearing loss (i.e. hidden hearing loss) can not be captured. Additionally, pure-tone audiometry is vastly dependent on subjective feedback. This can be problematic as giving informed feedback is challenging for some patient groups (e.g. babies that are born deaf or elderly people with dementia). Here we propose the "Neurogram", a possible way to overcome the shortcomings of pure-tone audiometry by using a combination of system identification approaches, magnetoencephalography and a naturalistic listening situation (a radio play). By subsequently fitting linear encoding and decoding models we regress features of an acoustic signal (e.g. spectrograms) from related measured brain activity. We find that the decodability of acoustic information decreases with individual hearing capacity measured using pure-tone audiometry. Furthermore, we found a stronger relationship between subjective reports of speech perception (assessed using the Speech, Spatial and Qualities of Hearing Scale) and the here proposed "Neurogram" compared to pure-tone audiometry. In the future we aim to further develop this approach and work towards a diagnostic procedure that allows clinicians to fit hearing aids optimally based on a characterization of individual hearing impairment without solely relying on subjective feedback.

36 Dangerous ground or spectacular leap? Do 1- to 2-year-olds attribute value by cost-benefit analysis?

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When do children understand that a goal is not simply the end-point of an action, but something of value? According to Liu et al. (2019), 13-month-old children infer the value of a goal from the danger of an action using a cost-benefit analysis. When shown an agent jump (or refuse to jump) over trenches of different depth to meet up with one of two individuals, infants' looking times suggested that they expected the agent to approach that individual for which the agent had accepted a higher risk (viz. jumped over a deeper trench). We successfully replicated Liu's findings with N = 32 adults (M = 30.25 years), of which 88% expected the agent to approach the 'higher risk' individual. Now, we attempt to replicate Liu's findings in 1- to 2-year-olds. In addition, we want to test the alternative explanation that simpler attention processes are responsible for the data: The more dangerous a jump, the more spectacular it is, the more attention is drawn (also) to the bystander individual. At test, participants attend more strongly to that individual which leads to differences in looking time depending on which individual the agent approaches. Data collection is currently in progress. I will present the results at SAMBA meeting.

37 Ontology-driven conceptual modeling in Cognitive Neuroscience: A way towards reusable data?

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Managing the vast amounts of data produced daily might very well be one of the most critical challenges Cognitive Neuroscientists need to face within the next decade. However, it is no longer the sheer volume that poses a challenge, but mainly the variety of data. To answer complex questions, we need to integrate different sources of data as well as the interpretations derived from there. Thus, it is inevitable to address the issue of semantic interoperability. Semantic interoperability focuses on disambiguating the meaning of data to enable exchange between multiple information systems. This, in turn, requires harmonizing the meaning of domain-relevant concepts, their properties, and interrelations. So far, knowledge on the relations between our objects of research, theoretical accounts, experimental settings, methodological choices, and analysis decisions mainly guides our research process implicitly. Yet, to guarantee semantic interoperability and hence knowledge discovery, we are obliged to make our implicit knowledge explicit. Ontology-driven conceptual modeling is a technique in Computer Science that enables us to explicate our knowledge unambiguously so that it becomes machine-actionable. Here, we exemplify the expressivity of the theoretical framework and methodological environment provided by the Unified Foundational Ontology with a model fragment. Ultimately, a comprehensive ontology-based annotation system for data indexing and retrieval can act as an essential backbone for effective reusability, rendering data semantically situated and clearly described within a controlled meta-data schema.

38 Cognitive performance is not worse when fasted, a preregistered meta-analysis

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Introduction: Does skipping breakfast or fasting for several hours worsen cognitive performance?Previous research investigated this question by assessing a variety of fasting interventions and cognitive tests. Bringing together these different approaches, we assess whether fasting effects are dose-dependent and depend on study design- and sample-characteristics in a preregistered meta-analysis (PROSPERO ID: CRD42021272822).

Methods: We searched seven electronic databases for relevant experimental studies. We considered experiments with a zero-calorie fasting intervention and a standardised cognitive performance measure. In total, 17,419 studies were screened, 55 were entered into the meta analysis, with 156 effect sizes and a combined sample of N=2,372. The median fasting duration was 12 hours. A three-level random-effects model was fit to the standardised mean differences in cognitive performance between the fasted and satiated condition.

Results: Cognitive performance in the satiated condition was slightly and insignificantly higher than in the fasted condition (SMD = 0.05, SE = 0.04, 95%CI = [-0.02, 0.12], p = 0.17). The heterogeneity in the model was I2 = 32.17%. Adding fasting duration as a predictor, the difference in cognitive performance between the satiated and fasted condition decreased for longer fasting periods (coefficient = 0.004, SE = 0.001, 95%CI = [-0.006, -0.0015], p = 0.001).

Conclusion: There is no significant difference in cognitive performance between fasted and satiated participants. There is a small, negative dose-response relation with the the fasting-duration.

Future studies following participants over several fasting iterations or longer fasting periods could help shed light on individual cognitive responses to fasting.

39 Magnetic resonance imaging under isoflurane anesthesia alters cortical cyclooxygenase-2 expression and glial cell morphology during sepsis-associated neurological dysfunction in rats

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Background: Magnetic resonance imaging (MRI) of rodents combined with histology allows to determine what mechanisms underlie functional and structural brain changes during sepsis-associated encephalopathy. However, the effects of MRI performed in isoflurane-anesthetized rodents on modifications of the blood-brain barrier and the production of vasoactive prostaglandins and glia cells, which have been proposed to mediate sepsis-associated brain dysfunction, are unknown.

Methods: This study addressed the effect of MRI under isoflurane anesthesia on blood-brain barrier integrity, cyclooxygenase-2 expression, and glial cell activation during cecal ligature and puncture-induced sepsis-associated brain dysfunction in rats.

Results: Cecal ligature and puncture reduced food intake and the righting reflex. MRI under isoflurane anesthesia reduced blood-brain barrier breakdown, decreased circularity of white matter astrocytes, and increased neuronal cyclooxygenase-2 immunoreactivity in the cortex 24 hours after laparotomy. In addition, it annihilated cecal ligature and puncture-induced increased circularity of white matter microglia. MRI under isoflurane anesthesia, however, did not alter sepsis-associated perivascular cyclooxygenase-2 induction.

Conclusion: These findings indicate that MRI under isoflurane anesthesia of rodents can modify neurovascular and glial responses and should, therefore, be interpreted with caution.

40 Measuring interpersonal synchrony in EEG and movement

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Interpersonal coordination also termed synchrony is ubiquitous in human interaction from joint action to communication, but also in sharing emotional states and experiencing social bonding. Therefore, it is not surprising that synchrony, especially mutual synchrony, is a dominant factor in social interactions right from birth. However, we do not yet understand how this synchrony is established and used. Towards this goal a reliable measurement of interpersonal synchrony incorporating both precise behavioral and physiological data is needed.

There are multiple methods of quantifying synchrony including cross-correlation, wavelet cross-coherence and windowed multiscale synchrony however these methods have not yet been compared in processing real (i.e. not simulated) motion capture and EEG data of pairs of adults acting in a synchronized manner over short time periods. In the current preliminary study high-density EEG and full body motion capture data was recorded from 3 pairs of adults performing the mirror task of Noy. The resulting time series were analyzed both within and between participants, and within and between movement and EEG using cross-correlation, wavelet cross-coherence and windowed multiscale synchrony. Preliminary results show that both wavelet based methods provide detailed temporal dynamics of synchronization which may provide deeper insights into interpersonal synchrony in future research utilizing these methods.

41 Multidimensional pattern analysis exploiting Multielectrode motor evoked potentials (MultiMep): a new TMS-MEP recording approach

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Motor evoked potentials (MEPs) are often exploited to make inferences about the neurophysiological state of the motor cortex. However, MEPs suffer from numerous limitations: MEPs can be quite variable between trials of similar conditions, and might be deeply affected by crosstalk arising from the activity of neighbooring muscles. Eventually, given the usually poor spatial resolution of the classical MEP recordings, actions to prepared, imagined, or observed, are usually quite simple and unecological. The present work aims at exploring methods to overcome these limitations introducing the concept of MultiMEP, i.e, recording surface electromyographic activity from multiple evenly spaced regions of the hand/forearm. Participants underwent a simple choice reaction time paradigm in which they were required execute, after a go-sound, the action cued at the onset of the trial. In half of the trials a supra-threshold single pulse transcranial magnetic stimulation (TMS) was delivered approximately after 130 ms from the go-sound. We recorded MEPs from 12 electrode positions along the participants' right forearm, in an EEG-like fashion. We then aimed at classifying the three prepared actions during the task by feeding supervised classification algorithms with the pattern of MEP amplitude recorded in each trial. Preliminary results show that, exploiting MultiMep, prepared actions can be classified above chance. MultiMEP recording are discussed both relative to single position recording and to the possibility of testing the motor system state using more ecological actions.

42 Accurate Localization and Connectivity of the Frontal Eye Field and Inferior Frontal Junction

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The prefrontal cortex is essential for several forms of goal-driven behavior. The frontal eye field (FEF) and the inferior frontal junction (IFJ) are specialized in the control of spatial vs non-spatial attention and working memory. The limited quantitative evidence on their precise localization however considerably impeded the understanding of their connectivity, which we hypothesize is a critical aspect that supports their functions. We performed an activation likelihood estimation (ALE) fMRI meta-analysis to accurately infer the localization of FEF and IFJ in MNI152 space. Only saccadic functional localizers were included in the FEF sample, whereas covert attention, n-back, Stroop and task-switching experiments were included in the IFJ sample (n = 35 and 30, respectively). The ALE peak coordinates were then employed as seeds for meta-analytic connectivity modeling (MACM), to uncover their whole-brain coactivation patterns, and surface-based probabilistic tractography, to infer their structural connectivity. Using ALE, we found two pairs of bilateral clusters whose peaks were localized at the junctions of the precentral and superior frontal sulcus (FEF), and the precentral and inferior frontal sulcus (IFJ). MACM showed that FEF and IFJ coactivated with the posterior parietal cortex, the supplementary/cingulate eye field and reciprocally, but differential IFJ coactivations were observed with insular and inferotemporal cortices. Probabilistic tractography moreover revealed predominant structural connectivity from FEF to the dorsal visual stream, and from IFJ to the ventral visual stream. The connectivity patterns of FEF and IFJ support their role in spatial vs non-spatial attention, extending the two visual stream architecture to the prefrontal cortex.

43 MEG frequency-tagging reveals the emergence of a grid-like code during covert attentional movements

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Grid-cells in the entorhinal cortex represent space with a 60° periodicity, providing a reference system for spatial navigation. Recent evidence in monkeys demonstrates grid-cells recruitment independently of eye-movements, suggesting the contribution of attention to the generation of the grid-code. We investigated whether movements of covert attention can elicit grid-like coding in humans by concurrently recording MEG and eye-tracker. To obtain a measure of grid-like signal non-invasively with high SNR, we developed a new paradigm based on frequency-tagging. While keeping central fixation, participants were presented visually with sequences of linearly-spaced trajectories (15° or 30° in different conditions) formed by static lines or moving dots in separate sessions. Trajectories appeared sequentially on the screen at a fixed rate (6 Hz), allowing different spatial periodicities (e.g. 45°, 60°, 90°) to have corresponding temporal periodicities (e.g. 1, 1.5, 2 Hz), thus resulting in distinct spectral responses in the recorded brain signal. Analyses of inter-trial coherence evidenced a higher response for the 60° periodicity than the control periodicities. This effect was localized in medial temporal sources and not in control regions. Moreover, in a control experiment using a recurrent sequence of letters featuring the same temporal periodicity but lacking spatial structure, the sixfold effect did not emerge, suggesting its dependency on the spatial periodicity of grid-like firing fields. We report the first evidence, in humans, that grid-like signal in the medial temporal lobe can be elicited by covert attentional movements. Moreover, we propose a new neuroimaging paradigm based on frequency-tagging to study grid-like activity non-invasively.

44 The effect of attention on the formation of feature specific auditory predictive patterns.

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Our brain is not a passive processor of external stimuli. On the contrary, in order to be able to cope with the fast pace of the changing world outside, it constantly predicts and tries to anticipate what the future sensory events could be. While nowadays the idea behind the predictive coding framework as a hierarchical generative model of the human brain seems to be assessed, the effect of attention has yet to find a consistent role in this model. In the current work, with the usage of MEG data and machine learning tools, we show that, despite being present, at least for the auditory domain the effect of selective exogenous attention plays indeed a minor role in the formation and utilization of feature specific predictive sensory patterns.

45 Criterion learning for perceptual decision making

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The ability to make decisions that lead to good outcomes even in situations where perceptual evidence is uncertain is central to behaviour. In the lab, this ability is often studied in simple tasks where a subject has to distinguish between two stimuli. Perceptual decisions like these are commonly described using signal detection theory (SDT). The choice is assumed to be based on a single criterion to separate the two stimulus categories. However, where this criterion is set and how it is learned or updated is not answered by SDT. On the other hand, animal learning theory provides insights into the relation between received rewards and choice behaviour in such tasks. The relation is described by a law akin to the generalized matching law, extended to perceptual tasks. In our work, we rephrase this law in terms of SDT criterion setting. From this follows a constraint on the ratio between criterion updates after each stimulus category, assuming any model where the criterion is updated whenever the subject receives a reward. We design a model that fulfils this constraint. The criterion update steps in this model depend on the expected income from each choice option, which is unknown to the subject. By replacing the expected income with an estimate thereof based on the history of received incomes, the model becomes more realistic. Simulations show that the asymptotic behaviour of our model is consistent with the law from animal learning theory.

46 Newborn infants differently process random and regular tone sequences

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Pattern matching is one of the mechanisms supporting the extraction of auditory objects from a noisy environment, a process crucial for development and survival. Previous research on adults suggests that auditory pattern and mismatch detection are automatic processes. Furthermore, EEG mismatch responses for outlier frequencies are enhanced in tone sequences consisting of regular repetitions of a tone pattern compared to random tone sequences. However, it remains an open question whether the ability to distinguish between random and regular tone sequences and the observed enhanced outlier detection in a regular tone sequence context are innate in humans. We presented pure tone sequences with a repeated, predictable structure or a random structure (50% probability each) to sleeping newborns (N=32) while EEG was recorded. In both conditions, 50% of the trials included a frequency outlier. The global field power was different in trials with random compared to regular sound sequences. A significant mismatch response for frequency outliers was observed in the regular but not in the random sequence condition. These results suggest that automatic processes of auditory object formation based on sound predictability and mismatch detection are already functional at birth.

47 Reliability of EEG resting-state networks

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Functional connectivity (FC) has become a major neuroscientific tool to characterize coordinated activity across functionally specialized brain areas. A large number of studies investigated the reliability of FC, most commonly using fMRI data. However, fMRI FC captures functional relations on a timescale of seconds, while research relies on EEG for shorter time-scales. The present study focuses on the reliability of FC networks as measured with resting-state EEG rhythms (0.5-80 Hz) on a large sample of young healthy adults (N = 202; mean age = 22.4 +/- 3.1). Reliability was tested both within subjects and across groups with varying sizes, comparing different FC methods (based on phase synchronization and amplitude envelope correlation), epoch lengths (1-9 s) and frequency bands (delta, theta, alpha, beta, gamma). The data revealed significant effects of all three factors (FC method, frequency, and epoch length) on the reliability of estimated FC networks. FC methods corrected for spatial leakage produced lower reliability than their uncorrected counterparts, while the effect of frequency and epoch length showed FC method-dependent patterns. The results can provide guidance for FC estimation in future studies and for meta-analyses.

48 Speech processing in multi-talker situations: The role of speaker similarity

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Multi-talker environments require the listener to separate the speakers' voices from each other and sustain attention on one of them. Speakers whose voice is perceptually similar are presumably harder to tease apart. However, while the dissimilarity of voices may ease their separation, it is unclear whether it has an effect - positive or negative - on sustained attentional focus. Therefore, we collected electrophysiological (EEG) and behavioral data while 22 healthy young adults listened to two concurrent speech streams consisting of either 1) identical, 2) similar, 3) dissimilar, or 4) opposite-gender speakers. Speaker similarity was assessed beforehand on the basis of the perceptual judgement of 20 separate participants. We concluded based on functional brain connectivity, ERP and target detection data that, while speaker similarity hinders auditory stream segregation, dissimilarity hinders attentional focus by making the speech stream to be ignored more distracting. The problem to be solved by the speech processing system in multi-talker situations is thus different depending on the level of perceived speaker similarity. We discuss these conclusions in detail in the poster.

49 The role of prediction in face-to-face communication: concurrent recordings of EEG, gaze direction and gestures during verbal interactions.

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How do interlocutors achieve mutual understanding during face-to-face verbal communication? Previous research stressed the importance of 1) brain and behavioral synchronization and 2) prediction as the main mechanisms behind successful communication. The current study aims to tie these concepts together and tests the hypothesis that the primary goal of interlocutors is to elicit predictable responses from their partners. Responses provide feedback about understanding and agreement and help communicating agents to build more accurate models of each other over time. A further assumption is that agents mutually and continuously predicting each other leads to synchrony on multiple levels. In a series of experiments, we ask participants to engage in verbal interaction with each other (a "Bargaining Game" and a "Free Conversation") while EEG, upper-body motion, gaze direction, speech audio and video are collected from both participants together with measures of the efficacy of communication. Using subjective and machine-learning based measures of speech predictability we can compare behavioral and brain measures of synchronization between highly predictable and unpredictable conversation segments. We also test the effects of familiarity of the interlocutors and modality of communication (face-to-face versus audio). The current study is still in the data collection phase, thus, only methods and preliminary data are presented. However, we expect to find 1) a positive relationship between the general level of predictability and communication efficacy, 2) that high predictability is linked with larger synchrony and vice-versa, while 3) familiarity and 4) access to visual information should improve predictability, communication efficacy and synchrony.

50 Early signs for age related neural decline in the central auditory pathway during listening in a noisy environment

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Listening in a noisy environment relies on our ability to extract structure from noisy sensory input while segregating it from the rest of the scene (Figure-Ground Segregation - FGS). To assess whether central or peripheral processes of FGS are impaired by aging, source localized brain activity was analyzed from young, older adults, and hearing-impaired (HI) elderly during object detection in noise. Listeners' task was to report whether they detected a figure (rising sound stream) within either high or low noise. Individualized 'figure' and noise levels allowed us to compare groups across the same performance levels (65% vs. 85% accuracy). HI group was impaired in parsing sounds of the temporally coherent figure. Figures elicited an early sensory processing-related (object-related negativity- ORN) and a later perceptual decision-related (P400) brain response. In the elderly, compared to the young the ORN was delayed in general and smaller in the inferior frontal gyrus (IFG). P400 activity was generated within a less distributed network in both the elderly and HI relative to the young. In the HI, compared to the elderly the ORN was smaller in the auditory cortex and IFG. Our results suggest that early FGS processes are disturbed only neurally in the elderly and overtly in HI.

51 Brain network representation of the topic in speech comprehension

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A sentence outside context provides very restricted information to the listener. Real understanding requires one to be able to place it within the sequence of sentences forming a coherent “story” and just as importantly, within one’s general knowledge of the “topic”. Much work has focused on how speech is integrated temporally into events and, ultimately, into the story, while less is known about the role of the topic. Here we demonstrate the existence of a functional brain network robustly sensitive to the topic of ca. 6- minute-long coherent newspaper articles. Main network hubs are located in parietal and temporal brain regions. These networks changed very slowly during the course of the article, consistent with their involvement in representing the topic rather than the story aspect of the context. Because even the meaning of words can depend on the topic (see e.g., the word “shuttle” in transportation and weaving) the topic-sensitive network must be intimately linked with the mental lexicon underlying language comprehension.

52 Neural responses to social reward and social punishment in adolescents with Major Depressive Disorder

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Alterations in neural processing of reward and punishment are considered a crucial factor in the pathophysiology of Major Depressive Disorder (MDD) in adolescents. Most studies investigating neural responses during reward processing use monetary incentives, but responses to social rewards may be particularly relevant for understanding MDD, especially in adolescents. The present study investigated neural processes during anticipation and consumption of social reward and social punishment in adolescents with MDD. Event-related brain potentials were recorded from 25 adolescents with MDD and 28 controls (12 – 17 years) while they performed a Social Incentive Delay Task (SIDT) consisting of a social reward and a social punishment condition. Attentional allocation during anticipation and outcome phase was captured via cue-P3 and feedback-P3, respectively. Outcome evaluation was analysed via the reward positivity (RewP). There were no significant differences between the MDD and the control group in amplitude or peak latency for cue-P3 and feedback-P3. RewPs did not differ between groups. However, in adolescents with MDD, higher depression scores (BDI-II) correlated with a longer feedback-P3 peak latency in the social reward condition for trials with positive outcome. Contrary to studies on non-social incentives, these results indicate that neural responses to social reward and social punishment are not altered in adolescents with MDD. The connection between depression severity and feedback-P3 latency in trials with positive outcome could imply that a worsening of depressive symptoms is accompanied by a decreased salience of rewarding social stimuli.

53 Social-evaluative threat influences reaction tendencies and neural processing of social stimuli.

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Facial expressions contain social-evaluative cues that can help restore a threatened need to belong by either confrontation (i.e. faster approach of angry faces) or seeking social connection (i.e. faster approach of happy faces). The aims of the present study are, first, to investigate whether the neural processing of facial expressions increases after a social evaluative threat; second, to explore whether reaction times towards facial expressions increase after such a threat. For these purposes, social-evaluative threat (SET) was induced in eighty participants, via an impromptu public speaking task. Before and after SET, they completed an approach avoidance task (AAT) with happy, angry and neutral faces, during which event-related potential (ERP) components N1, P150, N2, and P3 were measured. Furthermore, stress indicators i.e., cortisol levels and self-report anxiety were measured. Preliminary analysis shows a main effect of time in the N1 ($F (1, 50) = 5.31$, $p = .025$) and the N2 event-related potential components elicited by these faces ($F (1, 50) = 8.33$, $p = .006$). Moreover, participants became faster to approach both happy and angry faces. Further analysis is needed to investigate whether changes in the ERP components are related to changes in stress indicators. However, based on these preliminary findings, it is likely that SET influences the neural processing of faces.

Keywords: social-evaluative threat, anxiety, approach-avoidance task, EEG, facial expressions

54 Additive or interactive? An investigation into the relationship between word frequency and predictability

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The effect of word frequency and word predictability count among the most researched phenomena in reading research. Whether these factors interactively or additively impact reading, however, is still discussed. An interactive effect of word frequency and predictability would suggest an early lexical locus of context effects, where both variables are processed concurrently in early stages of word recognition. An additive effect of word frequency and word predictability in the sense of a modular architecture would suggest that the processing of contextual influences is relatively delayed and doesn't occur until the post-lexical phase. Predictability and frequency have been shown to reveal higher activation in response to less predictable/low-frequent words, compared to predictable/high frequent words within several left-lateralized clusters, including the left IFG and left OTC, which is assumed to contain the (alleged) VWFA. We evaluated the interaction between predictability and frequency during silent reading of whole sentences, using functional magnetic resonance imaging and simultaneous eye-tracking (fixation-related fMRI). First analyses revealed mainly additive effects, suggesting a delayed involvement of context during natural reading.

55 The trans-saccadic preview effect: Adaptation or active vision?

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Our eyes move about three times per second which divides apparently continuous vision into rather discrete snapshots. These spatiotemporal dynamics imply that we never see something completely new. There is always a extrafoveal preview of upcoming foveal input which impacts on foveal processing. Preview effects can be found in task performance, eye-movement behavior, and fixation-related neural responses. However, at least three theoretical accounts can explain in particular the early post-saccadic preview effect in fixation-related neural responses which has previously been reported by us. First, early post-saccadic preview effects could simply result from adaptation of neurons with very large receptive fields which would mean that the preview effect could be largely independent from active vision. Second, they could result from processes that are specific to eye movements which would indicate that the preview effect relies on active vision. Third, they could result from spatiotopic adaptation which would be related to eye-movements but make opposite predictions compared with the active vision account under certain experimental conditions. Here, we present an experiment designed to differentiate between these theoretical accounts and we present preliminary results from a MEG and eye-tracking coregistration study.

56 Testing a stimulus set designed to investigate the built environment

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In public places it is important to allow for people's need fulfillment providing privacy, autonomy, and social inclusion in order to promote wellbeing. If these needs are violated, people perceive a discrepancy between expectation and reality that can be considered a threat according to the General Model of Threat and Defense - causing a specific motivational-affective reaction. If characteristics of a built environment are violating people's needs these should thus trigger threat reactions. Here we investigated design features in the light of need violations and manipulated the degree of privacy of a university environment (UE), the degree of biophilia, a warm/cold contrast and the degree of minimalism via computer-aided design. In a later phase, we plan to consolidate these findings using neurophysiological methods in addition to this behavioral approach. Thus, this work is a first step towards a stimulus set that enables us to perform such neurophysiological studies. In study 1a (n= 260) participants indicated they wanted to enter private UEs more than non-private UEs, and felt more competent, autonomous, and socially included in private UEs. In study 1b (n= 220) participants wanted to enter warm, biophilic UEs, felt more competent, autonomous, and socially included than in cold or non-biophilic UEs. Future research should address this novel threat-theoretic approach to better design public spaces according to human needs and make use of the newly created stimulus set.

57 Identifying Salient Spatial Features Found at Later Alzheimer's Disease Stages Using Data-Driven Multivariate Pattern Analysis and Resting-State fMRI

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Background: Functional connectivity (FC) measures the similarities in the "blood oxygen level dependent" response between spatially distant brain regions. Alzheimer's disease (AD) is a progressive neurodegenerative disease, to which there is no cure. Alterations in FC between brain regions may compromise information transfer, contributing to symptoms associated with AD, e.g., memory impairment.

Methods: MRI and fMRI data was derived from the Alzheimer's Disease Neuroimaging Initiative study. 252 participants at baseline were included in this cross-sectional study. Participants were aged 60-90 and were cognitively normal (CN), n = 167; mild cognitive impairment (MCI), n = 68; or AD, n = 17.

Statistical analysis: Multivariate Pattern Analyses (MVPA) measured for differences in FC across the whole brain. MVPA analyses a set of voxels together, forming a voxel-to-voxel "connectome" - instead of modelling a seed-voxel and analysing each voxel separately.

Results: No significant results were found between CN and MCI participants (e.g., FC being higher among CN than MCI; denoted as CN>MCI). The left Thalamus and Precuneus were found to show the most FC alterations between stages (CN>AD and MCI>AD). The Thalamus has been implicated in motor and sensory signal processing. Whereas the precuneus is an instrumental node of the default mode network, and is associated with memory, visuospatial processing, and aspects of consciousness.

Conclusions: The left Thalamus and Precuneus may hold particular importance in AD development. Future studies may benefit in looking more closely into these regions, as to potentially aid in identifying those at-risk of future AD.

Information

The SAMBA-Meeting takes place at the *Unipark-Nonntal*.

University of Salzburg
Unipark Nonntal
Erzabt-Klotz-Straße 1
5020 Salzburg, Austria

How to get to the venue?

By car

Motorway A10 exit Salzburg Süd / Anif (in the direction Salzburg Zentrum). Go along Alpenstraße for about 6 km until you reach the Shell filling station. Turn left in the Akademiestraße. Take the first exit in the roundabout traffic and follow the Ulrike-Gschwandtner-Straße. After the sports centre you will find Unipark and the entrance to its paring area Unipark / Nonntal.

Parking areas at or nearby the venue (with costs):

- Tiefgarage Unipark / Nonntal
- Tiefgarage Hypogarage (1-minute-walk),
- Parkplatz Akademiestraße (5-minute-walk)
- Parkplatz Petersbrunnhof (5-minute-walk)

Public transport

Bus tickets can be purchased at kiosks (so called “Trafik”), vending machines or if you directly ask the bus driver (which is a little more expensive). To find the perfect connections via public transport in Salzburg please go to salzburg-verkehr.at/en.

Bus stations near the venue:

- Unipark (in front of the faculty)
- Justizgebäude

From the main train station

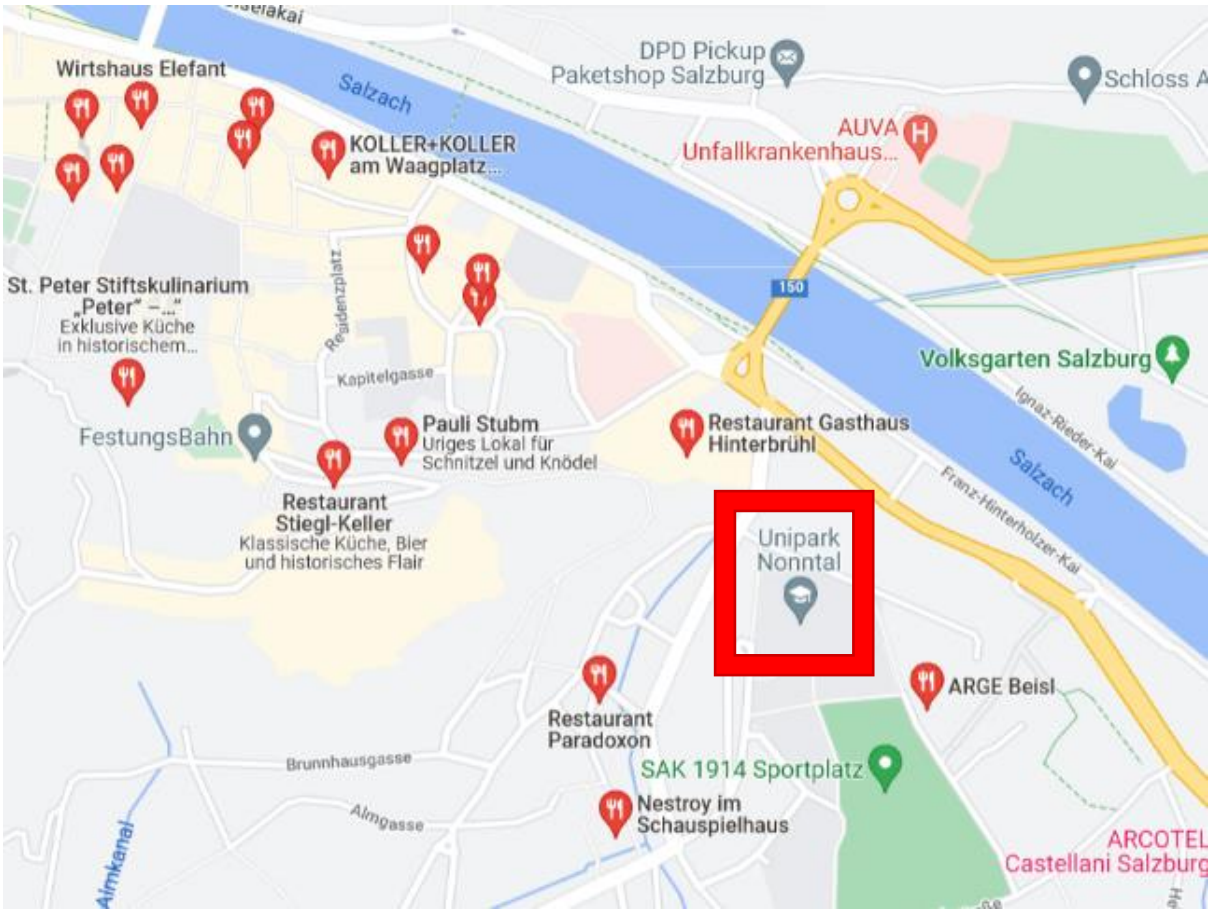
- Option 1: take the bus line 25 (in the direction of Grödig Untersbergbahn) or bus line 5 (in the direction of Birkensiedlung) until the exit Justizgebäude (11 min, 6 intermediate stops). The Unipark is in ~120 m walking distance.
- Option 2: take the trolley bus line 3 (in the direction of Salzburg Süd) or 6 (in the direction of Parsch) until the exit Justizgebäude (11 min, 6 intermediate stops). The Unipark is in ~350 m walking distance.

From the airport

Take the trolley bus line 10 (in the direction of Sam) until the exit Justizgebäude (21 min, 13 intermediate stops). The Unipark is in ~320 m walking distance.

Local Supply

The venue is very close to the city center, which offers lots of opportunities.



Nearby spots for lunch

- Eden Skybar (directly at Unipark)
- Arge Beisl
- Uncle Van Nonntal
- The Green Garden (Vegetarian & Vegan)
- Tula Bistro (Vegetarian & Vegan)
- Lemonchilli
- Lackners Auszeit
- Casa Antonio

Bars / Restaurants

Some places we recommend for having a good Austrian meal:

- Bärenwirt (city centre)
- Kastners Schenke (city centre)
- Restaurant Stieglkeller (city centre)
- Raschhofer Herrnau (10-minute-walk from the venue)
- Pauli Stubm
- Zum Zirkelwirt (10-minute-walk from the venue)
- Imlauer Sky Bar & Restaurant (25-minute-walk from the venue)
- Gasthof Überfuhr (25-minute-walk from the venue)
- Stadtalm (30-minute-walk from the venue)

To have a drink after the meeting we recommend:

- Times Bar
- The Dubliner Irish Pub
- Celtic Spirit
- Alchimiste Belge
- Whiskey Museum
- Darwin‘s
- Schnaitl Bier + Bar
- Mentor`s Bar
- Glüxfall Café – Bar
- SZENE Salzburg
- Wein & Co

Hotels / Hostels

Salzburg offers several accommodations. Some of them are listed below. You may also be interested in Airbnb.

- Via Roma
- Arcotel Castellani
- Motel One Alpenstraße
  If you walk it will take around 30 minutes. From the bus stop "Salzburg Polizeidirektion" you can take bus nr. 3 or 8 until the exit Justizgebäude (8 min, 4 intermediate stops). Then it is only a 5-minute-walk to the Unipark (~320 m).
- Austria Classic Hotel Hölle
- A&O Salzburg Hauptbahnhof
  By the trolley bus line 3 you can reach the venue easily, as described above (cf. *How to get to the venue*).
- Eduard-Heinrich Haus (hostel)
  If you walk it will take around 35 minutes. From the bus stop „Salzburg Herrnau" you can take bus nr. 3 or 8 until the exit Justizgebäude (6 min, 3 intermediate stops). Then it is only a 5-minute-walk to the Unipark.

Poster prints

If you need to print your poster directly in Salzburg, you can do it in one of the local copy shops. We recommend contacting the copy shop before your arrival and ask for the exact conditions and prices.

- University of Salzburg Printcenter (printcenter@sbg.ac.at)
- Colibri (nonntal@colibri-print.at)
- Copyprint (office@copypoint.at)

Social event

WHEN:

Friday, July 15th 2022, starting at 7:00 pm

WHERE:

“Bierheuriger”

Gaisbergstraße 20

5020 Salzburg, Austria

HOW MUCH:

Registration fee: 40€

The small financial contribution of 40€ (if you signed up for the social event, this was included in the amount you paid) includes all you can eat and drink.

Didn’t sign up for the social event?

No Problem!

We still have tickets for the social event at the registration desk, you can just register for the social event and get your ticket on-site.

Planning to join us at “Bierheuriger”?

Please bring your name badge and your ticket with you!

You will need to give your ticket to the staff at “Bierheuriger”.

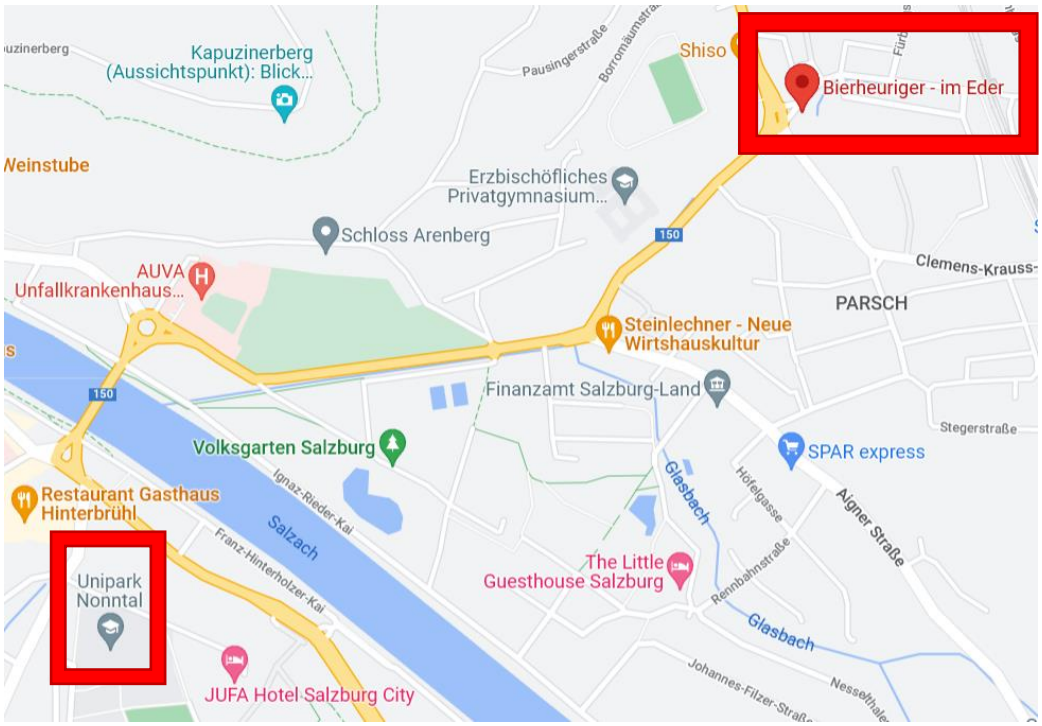
Location of the social event

This year's Social Event will take place on July 15th in **"Bierheuriger"**, which is one of the most popular beergardens of Salzburg. We can promise a good choice of local beers, Austrian food and, most importantly, lots of fun!

To prevent you from getting lost in a different pub, this is the location:

Gaisbergstraße 20

5020 Salzburg



WI-FI AND LINKS

You can use the following credentials for WiFi at the venue:

SSID: Plus_Event
User: samba
PW: Mind!2022

Find us online at:

University of Salzburg

SAMBA

CCNS

Salzburg Brain Dynamics Lab

@Salzburg_SAMBA