Poster Program

EEG Oscillatory Dynamics and ERP Signatures of Visual Environmental Processing

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This EEG study examined brain responses to environmental images (Pleasant, Neutral, Polluted) in 34 participants. Pleasant scenes increased alpha and beta power in left posterior areas, suggesting enhanced visuospatial and attentional engagement. In contrast, polluted scenes decreased delta and theta power across occipito-parietal regions, indicating disrupted sensory processing. ERPs revealed reduced P100 and P300 amplitudes for polluted versus pleasant images, alongside stronger Early Posterior Negativity (EPN) for pleasant stimuli. These results show that environmental valence significantly modulates oscillatory activity and visual-attentional processing.

The Neural Basis of Competitive Mindset: Emotion Regulation and Brain Responses During MOBA Gameplay

1) Jonathan M. Dong (Presenter), Lower Canada College, Montreal, Quebec, Canada. (2) Feng-Rui Zhang (Corresponding author), Washington University in St. Louis, St. Louis, MO, USA.

Competitive performance varies across individuals and is influenced by emotional regulation and neurocognitive responses. This study investigated the neural basis of competitive mindset during multiplayer online battle arena (MOBA) gameplay. 23 participants played Honor of Kings while EEG was recorded and emotion regulation was assessed using the DERS. ERPs were extracted for “slay” and “defeated” events. Results showed that emotion regulation ability significantly predicted gaming efficiency. ERP analysis revealed larger and P300-like components for defeat than for slay events, with ERP latencies correlating with both DERS scores and gaming ability. Structural equation modeling indicated that emotion regulation influenced ERP responses, and defeated-ERP significantly predicted gaming performance, suggesting a mediating role. These findings reveal how emotional processing of failure impacts competitive success, emphasizing the role of emotion function in high-pressure environments.

Socioeconomic and Educational Influences on Neural Correlates of Cognitive Function in Adults

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Socioeconomic status (SES) and educational attainment are key determinants of cognitive development and brain function. This study examined how parental education, family SES, and participants’ own education relate to neural activity during a flanker task and a visual search task. EEG data from 73 young adults were analyzed for ERPs and time-frequency features. Parental education was positively correlated with family SES but not with participants’ own education. In the flanker task, family SES was negatively associated with frontal P2 amplitude, and participants’ education was negatively associated with parietal N2 amplitude, suggesting effects on attention and conflict monitoring. In the visual search task, beta and gamma power were positively associated with parental education, though ERP features were unrelated to SES. These findings suggest that different aspects of socioeconomic background influence cognitive neural processing through distinct mechanisms.

A Novel Similarity Function for Detecting Subtle Changes in Biomedical Time Series Data

Presenter: Kwang-Ho Choi, Seong Jin Cho, Yeonhee Ryu, Affiliation: Korea Institute of Oriental Medicine

Accurate assessment of similarity between time series data is crucial in biomedical signal analysis, particularly for applications involving ECG and other physiological signals. Traditional methods, such as Pearson correlation, often fall short in capturing nuanced structural differences inherent in complex biomedical data. In this study, we introduce a novel similarity function designed to address these limitations by providing a more detailed and flexible evaluation of time series similarity. Our approach was validated through comprehensive experiments involving synthetic sine waves, biopotential signals, and real-world ECG datasets. The results demonstrate that our method offers superior performance in distinguishing subtle variations in signal patterns, which are often overlooked by conventional correlation-based techniques. This enhanced sensitivity to structural differences holds significant promise for improving diagnostic accuracy and monitoring in clinical settings.

Enhanced spatial resolution in EEG via super-resolution

Korea Institute of Oriental Medicine

This study proposes a U-Net-based super-resolution approach to enhance the spatial resolution of EEG signals. Resting-state EEG data were collected from 40 healthy participants using a 64-channel system and preprocessed into 2-second epochs. Functional PCA revealed that 20 electrodes preserved 95% of the signal variance, and clustering analysis identified 19 optimally placed electrodes aligned with the 10-20 system. A 1D U-Net autoencoder was trained on 4,800 epochs to reconstruct full-resolution EEG from the 19-channel input. The model achieved an average Pearson's correlation of 0.83 ± 0.16 across 72,000 predicted samples, with 83% exceeding a correlation of 0.7. Region-wise analysis showed strong performance across most brain areas, except the occipital lobe. These results demonstrate the feasibility if using a small number of well-positioned electrodes to reconstruct high-resolution EEG data, offering a promising solution for portable EEG systems in neuroimaging applications.

Shared and Distinct Face-Processing Activation Patterns in Mood and Schizophrenia Spectrum Disorders

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This study explores whether mood disorders (MDD, BD) and schizophrenia spectrum disorders (SSD) exhibit shared or subtle neural differences from healthy controls (HC) during face-processing tasks. Using unmatched (N=1570) and matched (N=388) datasets, we applied second-level statistical methods and conjunction analyses to clarify potential overlapping activation patterns across diagnoses. We hypothesized robust visual-limbic (fusiform, amygdala) activation in HC, MDD, and BD, but restricted occipital activation in SSD. Preliminary trends indicate subtle rather than pronounced differences among groups, possibly influenced by clinical factors or early illness stage. Future analyses, including TFCE correction and brain-behavior correlations with anxiety and depression symptoms, aim to clarify subtle diagnostic distinctions and underlying neural mechanisms.

Assessment of DICS under Multi-Source Low-SNR Conditions with Localization Optimization Strategies

Zoé Bolluijt, UGent

Dynamic Imaging of Coherent Sources (DICS) is a widely used beamforming technique in electrophysiological source imaging (ESI), particularly suited for localizing single oscillatory sources. However, simulations reveal that its performance deteriorates under conditions involving multiple active sources or low signal-to-noise ratios, leading to diminished spatial precision and increased source leakage. These limitations stem largely from the method’s reliance on the assumption of

uncorrelated sources which is frequently violated in real data. In this work, we examine the parameters contributing to these performance issues. Looking ahead, we aim to address these shortcomings by integrating approaches such as Multiple Sparse Priors (MSP) into DICS or alternative inverse methods. These strategies enable the modelling of source correlation and impose sparsity constraints, offering the potential for enhanced localization accuracy.

Neural and postural signatures of incentives processing

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Approach or avoidance behaviors toward appetite stimuli (such as alcohol and food) reflect the engagement of motivational states. Few studies investigated early motor and neural responses to these stimuli. Here, we adopted an integrated approach combining postural and electrophysiological measures to identify early automatic markers of incentives processing and the correlations between motor and neural responses. In this publication, we present an overview of recent analyses on this topic: posturographic responses, neural responses and the link between these two levels. In particular, a differential modulation of the beta (downward) and alpha (upward) spectral bands will be evoked in response to alcoholic stimuli compared to nourishing stimuli.. Moreover, for Food only, a significant increase in delta was found in posterior and central. We will present some preliminary data showing a possible modulation of these correlates by the participants' level of consumption.

Elucidating Auditory Segmentation Deficits in Cortico-Cerebellar circuits of First-Episode Psychosis

Jack Kavanagh University of Pittsburgh Medical Center Interventional Psychiatry

Auditory Segmentation Potentials (ASPs) reflect the classification of discrete acoustic patterns in an auditory scene. Using EEG we previously showed reduced ASPs in the Cingulate Motor Area for individuals within their first episode of psychosis (FEP). This present study aims to further investigate these results using Magnetoencephalography (MEG) to assess cortical and cerebellar ASP sources while attending or ignoring acoustic patterns. Thirteen FEPs and 18 healthy comparison individuals (HC) completed the metric melody mismatch task while watching a silent video. Button-press response to deviant trials was required during the attend condition. FEPs ASP amplitude was significantly higher than HC's in the right CMA ($p<0.01$), Auditory Cortex ($p<0.05$), and left Cerebellum Lobule VIIIB ($p<0.001$) in the ignore, but not the attend condition. These results indicate aberrant overexcitability of cortico-cerebellar networks in FEP.

Aberrant Auditory Segmentation Potentials in First-Episode Psychosis: Active vs Passive Attention

Hayley Rhorer, University of Pittsburgh Medical Center, Department of Psychiatry

Auditory segmentation potentials (ASPs) are event-related responses to discrete segments of auditory stimuli. We previously demonstrated that people experiencing first episode psychosis (FEP) had significantly reduced ASP amplitudes compared to healthy controls (HC). Here, we replicate and expand upon these findings by measuring ASPs during conditions of active and passive attention. Thirteen FEP and 14 HC ignored or attended to tone triplets (two separate tasks) while a silent nature video played concurrently. Button-press response to deviant trials were required during the active condition. HC ASP amplitudes were significantly larger during the active condition, while FEP amplitudes did not differ between conditions. These results show that FEPs may exhibit a reduced ability to establish/modulate pattern recognition to segmented acoustic stimuli, suggesting higher-order cognitive mechanisms that are crucial for auditory segmentation and processing may be affected early in psychosis.

Timing Dysfunction via Rhythmic Motor Tasks in First Episode Psychosis

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Schizophrenia is associated with impairments in processing of rhythm and timing, impacting perceptual, motor, and cognitive processes. We examined rhythmic motor timing in individuals with first-episode psychosis (FEP) to determine whether this cognitive dysmetria is apparent early in the disorder. We measured motor timing performance during EEG/MEG in 11 FEPs and 15 healthy controls via a 2Hz rhythmic finger tapping task. Performance was measured by the interval timing of button-presses relative to the target rate, and self-paced tapping variability defined by the standard deviation of the mean inter-tap intervals across the trials. The Wing-Kristofferson model was applied, dividing response timing variance into clock and motor subcomponents. FEPs displayed greater finger-tapping rate variability due to dysfunction in internal clock timing ($p<0.05$), providing evidence of neural timing impairments, perhaps due to reduced temporal precision of specific brain circuits.

Melodic and Rhythmic Perception Deficits in First-Episode Psychosis

Dylan Seebold, University of Pittsburgh Medical Center, Department of Psychiatry

People with schizophrenia have impairments of melody and rhythm perception assessed via the Montreal Battery of Evaluation of Amusia (MBEA) that correlate with deficits in social cognition. Here, we assessed MBEA performance and associations with social cognition in individuals within one-year of their first episode of psychosis (FEP) to determine whether these deficits are present early in the disorder. MBEA scores were assessed in 27 healthy controls (HC) and 15 FEP. MBEA scores were reduced in FEP compared to HC with the largest difference observed within the rhythm subtest ($p<0.001$). FEP showed a significant impairment in social cognition with a positive correlation between MBEA Temporality total score Social Cognition assessed by MCCB. Rhythmic processing deficits may highlight impairments in the coordination between sensory and motor areas that process time-estimation and rhythm perception, which may provide new targets for directed treatment of early psychosis.

Task-Based fMRI of Emotional Face Processing Across Psychiatric Diagnoses: A Transdiagnostic Study

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Background: Major psychiatric disorders such as MDD, BD, and SSD share neural and cognitive features, motivating transdiagnostic research. The Emotional Face Matching Task (EFMT) reliably elicits activation in emotion-related brain regions, yet few studies have examined transdiagnostic activation using task-based-fMRI. Methods: We plan to analyze EFMT contrast (fear+anger > shapes) using SPM12. Second-level models include two-sample t-tests (patients vs. HC), ANCOVAs, and conjunction analyses, controlling for age, sex, and coil type. ROIs include amygdala, insula, ACC, thalamus, hippocampus, PFC, and occipital areas. Results: Analyses are ongoing. Based on prior studies, we expect shared activation across diagnoses in salience and visual areas, and potential disorder-specific effects in higher-order cortical regions. Conclusion: This study may reveal transdiagnostic neural patterns during emotional face processing and inform dimensional models in psychiatry.

ZEREBRA - Open Source Modular Neurostimulation Framework

Louisa Bogner (TUM, zhaw), Julian Amacker (UZH, zhaw)

ZEREBRA is a python framework for EEG-based neurostimulation. Our motivation to build it stems from our work on enhancing slow waves during NREM sleep through closed-loop acoustic stimulation (CLAS). Initially driven by the need for more flexible CLAS protocols, it soon became clear that the

framework could also benefit other neurostimulation researchers. We are now working on releasing it as an open-source project.
ZEREBRA provides real-time signal processing and decision-making. Key features include: Modularity: Easily integrate custom algorithms, including machine learning-based approaches Accessibility: Well-documented, Python code lowers the barrier to entry Interoperability: Supports different EEG devices via BrainFlow. ZEREBRA manages data flow and processing throughout the pipeline. This enables researchers to focus on developing their algorithms (e.g. phase detection). We would be excited to present our work, exchange ideas and gather feedback from the community.

EEG Source Connectivity: Distinct Synchronization in Acoustically Evoked vs. Spontaneous Slow Waves

Julian Amacker, University of Applied Sciences Zürich (ZHAW), Institute of computational life sciences /University Children Hospital, University of Zürich (UZH)

Sleep slow waves (SW) comprise at least two subtypes: widespread, thalamocortical Type I and local, cortico-cortical Type II. We hypothesized that these types exhibit distinct thalamo-frontal connectivity patterns. Using high-density EEG, we quantified connectivity with Phase Transfer Entropy (PTE). Type I SW show significantly stronger connectivity from thalamic-adjacent regions to frontal cortex than Type II. PTE differentiates the two types, despite some distributional overlap. To further test this distinction, we used a machine learning approach. A Random Forest model trained on multivariate PTE features distinguished SW types with a mean F1-score and accuracy of ~0.78 using an optimal feature subset and leave-one-subject-out cross-validation. This classification, based solely on phase connectivity (independent of amplitude), provides strong evidence for functionally distinct SW subtypes and can inform the design of SW-type-specific targeted acoustic stimulation protocols.

Relationship among delta power, higher-order daily functioning, and slight cognitive decline.

Masafumi Yoshimura, Madoka Yamashita, Rumi Tanemura. Department of Occupational Therapy, Faculty of Rehabilitation, Kansai Medical University

This study compared the accuracy of detecting slight cognitive decline from normal to mild cognitive impairment (MCI) with wearable EEG measures and combined it with the higher-order daily functioning (HDF) measurement we have developed. Community-dwelling older participants (N = 25) underwent frontal activity measurement with a 3-channel electrode sheet affixed to the forehead area. The average potentials of the three channels were used to calculate the power spectral densities in the delta, theta, alpha, and beta frequency bands. As a result, only the delta power was related to general cognitive function assessed by the Montreal Cognitive Assessment Japan. Regression analysis revealed that cognitive function was better explained by combining the delta power and HDF measures (R = 0.68) than by delta power alone (R = 0.45). It was suggested that fluctuation in the delta frequency band, and its combination with HDF measures, may contribute to capturing slight cognitive decline.

Working Memory and Brain Function in Post-COVID Syndrome: Insights from fMRI

Presenter: Svenja Nückel, M.Sc.; AUTHORS: Svenja Nückel1, Katharina Gerg1, Lara Schulze Harling1, Maximilian Maywald1, Hanna Schlums1, Amelie Sommer1, Jana Ohlenhard1, Daniel Keeser1, Kristina Adorjan1, Hans Stubbe2, Felix Völk2, Fabienne Große Wentrup1, Aline Übleis1, Susanne Karch1 AFFILIATIONS: 1Department of Psychiatry and Psychotherapy, 2Medical Clinic and Polyclinic II

Neuroimaging studies in Post-Covid-Syndrome (PCS) patients reveal structural and functional brain changes, including altered gray matter volumes and microstructural disruption. This study examined whether PCS patients, compared to healthy controls, show altered brain activation during a working memory (WM) task and how these changes relate to cognition and symptom severity. 26 patients and 24 controls underwent neurocognitive testing and one MRI session with BOLD-fMRI during an n-back WM task. Post hoc tests showed significantly reduced accuracy and slower response times in PCS patients ($p<.01$). Random effects analysis revealed increased activation in regions linked to higher cognitive function, including frontal cortices, insula, and temporo-parietal areas. ROI-based

correlations with cognitive performance and symptom ratings are ongoing. PCS patients showed reduced WM accuracy and altered activation patterns, suggesting neural inefficiency and compensatory mechanisms in WM networks.

Electrical brain networks (eBNs) during seizures with impaired consciousness as ictal correlate

Montserrat Gerez-Malo

INTRODUCTION. Different types of consciousness impairment may occur during focal seizures. Yet, no region has been found to cause such impairments. The variability of experiential phenomena more likely involve widely distributed eBNs.

AIM: to identify patterns of altered eBNs connectivity during seizures with different types of psychic content.

METHODS: z-scored Information Flow (zInFlw) at 8 eBNs were correlated with level (ICI-L) and content (ICI-C) of consciousnes during electrical seizures (ES) in 10 psychiatric patients.

FINDINGS: Psychic changes were time-linked to ES in all patients. InFlw in the Default Mode Network (DMN) highly corelated with ICI-L. Different changes in other eBNs were related to individual differences in ICI-C.

CONCLUSIONS: 1) various types of consciousness impairment can be the only ictal correlate of an ES, focal or generalized, 2) ICI-L and ICI-C vary independently, 3) ICI-L highly correlates with DMN while ICI-C relates to other integrative eBNs.

Level and Content of Consciousness Duirng Seizures: Electrical Brain Networks's Correlates.

Montserrat Gerez-Malo

Generalized seizures typically abolish responsiveness and awareness, while focal seizures produce diverse impairments. Yet, altered consciousness content may ocurr with full awareness or even when responsiveness vanishes. We analyzed ten psychiatric patients with prolonged electrical seizures, applying the ICI scale during ictal activity. Z-scored Information Flow across eight eBNs was correlated with level (ICI-L) and content (ICI-C) of consciousness. Regression analysis revealed DMN connectivity predicted ICI-L, while other integrative networks modulated ICI-C, including hallucinations and thought disruption. One patient with ICI-L = 0 retained symbolic conscious content, (postictal report) challenging prevailing models. Our findings suggest that consciousness level and content vary independently and reflect distinct network dynamics.

Cognitive performance changes in Post-COVID patients following a video-based training program

Presenter: Nückel, Svenja; Schulze Harling, L.1 , Nückel, S.1, Gerg, K.1, Maywald, M.1, Schlums, H.1, Sommer, A .1, Ohlenhard, J.1, Keeser, D.1, Adorjan, K.1, Stubbe, H .2, Grosse-Wentrup, F.1, Übleis, A.1 & Karch, S.1, Affiliation: 1 Department of Psychiatry and Psychotherapy, Clinical Director: Prof. Dr. med. Peter Falkai, LMU Klinikum Munich 2 Medical Clinic and Polyclinic, Clinical Director: Prof. Dr. med. Julia Mayerle, LMU Klinikum Munich

Background: Approximately 36% of COVID-19 patients develop Post-COVID syndrome. Cognitive dysfunctions, including memory problems, are reported in 11% of cases*1.

Objective: This study investigated cognitive impairment in PCS patients using fMRI to objectify functional brain changes and effects of a training program.

Methods: Participants (n = 20) performed an n-back task during fMRI (T1). Patients were assigned to a therapy-group (n = 12; psychoeducation + cognitive training) or waiting-list group (n = 8). Post-intervention a second fMRI was conducted (T2).

Results: The therapy group demonstrated significantly faster 1-back responses, higher accuracy and revealed increased activation in working-memory related regions at T2.

Conclusion: Both groups improved, with greater gains in the therapy group, indicating a potential benefit of the intervention.

*1 Hou et al. (2025). Global Prevalence of Long COVID, its Subtypes and Risk factors: An Updated Systematic Review and Meta-Analysis.