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The 2021 Virtual Annual Meeting Program includes three Pre-conference Workshops, three Invited Addresses, five Big Idea Sessions, multiple Symposia, and one Post-conference workshop (one of the Pre-conference workshops repeated). Specific research topics will be covered in the Symposia. The majority of the research reports will be discussed at the Poster Sessions.

You will notice that the timing of events for this year’s Annual Meeting is a bit different than the typical conference schedule. We have made a concerted effort to make the meeting as accessible as possible for all attendees around the globe. With this in mind, each day of the Annual Meeting has been split between an ‘early’ session (morning in North America, afternoon in Europe) and a ‘late’ session (evening in North America, morning in Asia/Australia/New Zealand), with a break mid-day. This way, more attendees will hopefully be able to access the conference events live.

Of course, no single time works well for everyone, so this schedule is asking for some compromises from all. Thank you for your understanding, and we are looking forward to an outstanding SPR Annual Meeting!

We would like to thank all contributors for sharing their research and making this year’s Annual Meeting a rich and stimulating event!

Dan Foti
2020–2021 Program Committee Chair

Program Committee (2020–2021)
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Matthias Sperl, University of Marburg
Hunter Threadgill, Florida State University

Pre-conference Workshops

Sunday, October 10, 2021, 11:00 a.m.–3:00 p.m. EDT; 3:00 p.m.–7:00 p.m. UTC
Tuesday, October 12, 2021, 11:00 a.m.–3:00 p.m. EDT; 3:00 p.m.–7:00 p.m. UTC
Wednesday, October 13, 2021, 11:00 a.m.–3:00 p.m. EDT; 3:00 p.m.–7:00 p.m. UTC

Pre-conference Workshop: Mini ERP Boot Camp
Steven J. Luck, PhD
Center for Mind & Brain and Department of Psychology, University of California, Davis

Tuesday, October 12, 2021, 9:00 a.m.–1:00 p.m. EDT; 1:00 p.m.–5:00 p.m. UTC
Wednesday, October 13, 2021, 9:00 a.m.–1:00 p.m. EDT; 1:00 p.m.–5:00 p.m. UTC

Pre-conference Workshop 2: Ambulatory Psychophysiological Methods: Devices, Measures and Data Considerations
Jolie Wormwood, PhD1, Karen Quigley, PhD2, Prof. Dr. Eco de Geus2, Sarah Ostadabbas, PhD2, and Katie Hoemann, PhD2
1University of New Hampshire, 2Northeastern University, Vrije Universiteit Amsterdam, Katholieke Universiteit Leuven
Wednesday, October 13, 2021,
11:00 a.m.–3:00 p.m. EDT; 3:00 p.m.–7:00 p.m. UTC
Repeated:
Monday, October 18, 2021
9:00 p.m.–1:00 a.m. EDT; 1:00 a.m.–5:00 a.m. UTC (workshop is repeated from presentation on Wednesday)

Post-conference Workshop: Multilevel Modeling for Psychophysicologists
Elizabeth Page-Gould, PhD
University of Toronto

Program Highlights

Thursday, October 14, 2021
8:30 a.m.–10:00 a.m. EDT; 12:30 p.m.–2:00 p.m. UTC
Big Ideas Session: Physical & Mental Health

10:00 a.m.–11:30 a.m. EDT; 2:00 p.m.–3:30 p.m. UTC
President's Symposium on Diversity, Equity, and Representation
Sponsored by WISE and the Diversity and Outreach Committee

11:30 a.m.–1:00 p.m. EDT; 3:30 p.m.–5:00 p.m. UTC
Symposium 2.3
David Shapiro: His Life, Legacy, and Influence on Psychophysiology

4:00 p.m.–5:00 p.m. EDT; 8:00 p.m.–9:00 p.m. UTC
Invited Address
The Social Neuroscience of Prejudice
David Amodio, PhD
Professor of Psychology and Neural Science, New York University Professor of Social Psychology, University of Amsterdam

5:00 p.m.–6:30 p.m. EDT; 9:00 p.m.–10:30 p.m. UTC
Big Ideas Session: Psychophysiology across the Lifespan

6:30 p.m.–8:00 p.m. EDT; 10:30 p.m.–12:00 a.m. UTC
Workshop organized by SPR's journal Psychophysiology: Submitting Registered Reports to Psychophysiology
Andreas Keil, Senior Editor and Monica Fabiani, Editor in Chief

8:00 p.m.–9:30 p.m. EDT; 12:00 a.m.–1:30 a.m. UTC
Poster Session 1

Friday, October 15, 2021
8:30 a.m.–10:00 a.m. EDT; 12:30 p.m.–2:00 p.m. UTC
Poster Session 2

10:00 a.m.–11:00 a.m. EDT; 2:00 p.m.–3:00 p.m. UTC
Invited Address
Oscillatory Brain Activity in Humans: Selection, Suppression, Neural Sequestration and the Resolution of Environmental Competition
John J. Foxe, PhD
Killian J. and Caroline F. Schmitt Chair in Neuroscience, Director, The Ernest J. Del Monte Institute for Neuroscience.
Director, The University of Rochester Center for Brain Imaging, Professor & Chairperson, Department of Neuroscience, University of Rochester School of Medicine and Dentistry

11:00 a.m.–12:30 p.m. EDT; 3:00 p.m.–4:30 p.m. UTC
Presidential Symposium: Understanding Psychophysiological Processes within a Developmental Science Framework

12:30 p.m.–2:00 p.m. EDT; 4:30 p.m.–6:00 p.m. UTC
Big Ideas Session: Social & Cognitive Processes

5:00 p.m.–6:30 p.m.; 9:00 p.m.–10:30 p.m. UTC
Faces of the Future Flash Talks

6:30 p.m.–8:00 p.m.; 10:30 p.m.–12:00 a.m. UTC
SPR Anniversary Event: Past Early Career Award Symposium

6:30 p.m.–8:00 p.m. EDT; 10:30 p.m.–12:00 a.m. UTC
Big Ideas Session: Health & Aging

8:00 p.m.–9:30 p.m. EDT; 12:00 a.m.–1:30 a.m. UTC
Big Ideas Session: Interpersonal Psychophysiology

9:30 p.m. EDT; 1:30 a.m. UTC
Student Social
Invited Address

Diffuse Optical Imaging of the Human Brain
Gabriele Gratton, MD, PhD
Professor, Beckman Institute for Advanced Science and Technology, University of Illinois, Urbana-Champaign

11:00 a.m.–12:30 p.m. EDT; 3:00 p.m.–4:30 p.m. UTC

Early Career Award Addresses

Stress and Reward: Understanding Pathways to Depression
Anna Weinberg, PhD
McGill University, Montreal, Quebec

On the Relationship Between the Error-Related Negativity and Anxiety Across Development: From a Neural Marker to a Novel Target for Intervention
Alexandria Meyer, PhD
Florida State University, Tallahassee, FL

12:30 p.m.–1:30 p.m. EDT; 4:30 p.m.–5:30 p.m. UTC

Diversity and Outreach Committee Event

Building Inclusive Workplaces: An Evidence-based Framework
Aparna Joshi, PhD
Arnold Family Professor of Management, Smeal College of Business, Pennsylvania State University, Philadelphia, PA

5:00 p.m.–6:30 p.m. EDT; 9:00 p.m.–10:30 p.m. UTC

Poster Session 3

6:30 p.m.–7:30 p.m. EDT; 10:30 p.m.–11:30 p.m. UTC

SPR Business Meeting and Awards

7:30 p.m.–9:00 p.m. EDT; 11:30 p.m.–1:00 a.m. UTC

Saturday Night Social
Symposia Abstracts

Symposium 1.1

FACIAL EXPRESSIONS: FROM LOW-LEVEL PHYSICAL PARAMETER TO SOCIAL ACTIONS

Session Chair: Florian Bublatzky
Central Institute of Mental Health

Descriptors: Facial Expression, Face and Person Perception, Emotion

Human facial expressions convey a large amount of emotional and social information in a fraction of a second. However, the psychophysiological mechanisms involved in this social transmission process are not well understood. This symposium spans a broad range of current research on face and person perception, including computational, feature- and learning-based approaches to manipulating facial expressions and measuring the associated effects on central nervous (e.g., EEG/ERP, MEG) and peripheral physiological activity (e.g., startle EMG, SCR), behavioral performance (e.g., recognition, approach and avoidance decisions), and subjective evaluations (e.g., cross-cultural ratings). Stefan Schweinberger reports on parameter-specific face and voice morphing and its effects on the perception of emotions and social signals. Rachael Jack shows cross-cultural facial expressive patterns that dynamically transmit information in a cascading, broad-to-specific structure over time. Morgan Beaurenaut explores the impact of facial expressions and gender on vicarious threat and safety learning and its reversal. Finally, Julie Grèzes talks about action plans and goal-directed behavior when facing threatening others. Overall, this symposium takes an integrative perspective to approach face and person perception from basic facial features to recognition of facial expressions, social learning, emotion and behavior.

Funding: This work was supported in part by the German Research Foundation (BU 3255/1-2).

PARAMETER-SPECIFIC FACE AND VOICE MORPHING: PERSPECTIVES FOR INVESTIGATING EMOTIONAL AND SOCIAL PERCEPTION AND INTERACTION

Stefan Schweinberger, Celina von Eiff, Jürgen Kaufmann, Andrea Kowallik, Christine Nussbaum, Ayaka Tsuchiya, Verena Skuk Friedrich Schiller University

Parameter-specific morphing (PSM) techniques can enhance our understanding of the role of sensory information for processing social and affective signals from faces and voices. Following the invention of visual (image) morphing technology around 1990, and later of auditory morphing, PSM can now go beyond classical morphing, averaging, or caricaturing. Specifically, PSM allows to selectively manipulate independent parameters (e.g., 3D-shape and texture/colouration of faces, or fundamental frequency, timbre, and temporal aspects of voices). This can help to determine the relative importance of these stimulus characteristics for social perceptions of emotions, age, gender, or identity in neurotypical participants—but also in individuals with sensory or central impairments. For example, our behavioral and EEG experiments with faces consistently reveal a dominant role of texture over shape, but with individuals with poor face recognition skills relying disproportionately on shape—at remarkable variance with the idea that spatial configurual information is crucial to familiar face recognition. For voices, PSM helps to probe how hearing-impaired cochlear implant users, compared to normal hearing listeners, use acoustic information for perceiving nonverbal emotional and social signals. Overall, PSM is a promising novel approach to assess profiles of face and voice perception abilities with naturalistic stimuli. The impact of such sensory information on automatic imitation and dynamic interaction is currently unknown, but could become an intriguing focus of future research.

UNDERSTANDING DYNAMIC FACIAL EXPRESSION COMMUNICATION ACROSS CULTURES USING DATA-DRIVEN METHODS

Rachael Jack
University of Glasgow

Understanding how humans use facial expressions to communicate social messages has remained a central question for over a century. However, this is empirically challenging due to the complexity of human facial expressions. The use of traditional, theory-driven approaches and Western-centric biases have also restricted understanding. New data-driven methods and advances in analysis tools now alleviate these constraints, giving real traction and delivering novel insights. Here, I will showcase one such approach that can objectively and precisely model the dynamic facial expressions that communicate specific social messages within and across cultures, and novel analyses that can unravel the complexities of facial expression communication including their multiplexed signalling. We show that four, not six, core expressive patterns are cross-cultural, that distinct cultural accents refine their core messages, and that facial expressions dynamically transmit information in a cascading, broad-to-specific structure over time reflected in behavioral and brain (MEG) responses. Together, our work challenges longstanding beliefs of cultural universality and forms the basis of a new theoretical framework. Finally, we show how our dynamic facial expression models can be directly transferred to digital agents to improve their social signalling capabilities, thereby presenting new opportunities for Psychology to play a central role in designing new technologies.

PROCESSING OF FEAR-GAZE COMBINATIONS UNDER THREAT-OF-SCREAM PROCEDURE

Morgan Beaurenaut1, Gaïa Ozeray1, Emilie Meaux1, Guillaume Dezecache2, Julie Grèzes2
1PSL Research University, 2Université Clermont Auvergne

When we are collectively threatened, socio-emotional cues become highly relevant signals. More particularly, the combinations of fearful display and gaze orientation emitted by others can provide crucial information about the presence and location of danger, but also about whether the signaler is in distress or can provide mutual support. While it has been shown that processing of fearful faces is prioritized under threat, the question remains as to which of these two social meanings is facilitated when observers are themselves under threat. To address this question, 32 participants performed a categorization task with morphed faces ranging from neutral to fearful displays associated with a direct or averted gaze while we modulated their anxiety state using a threat-of-scream procedure. To this end, this task was divided into both “threat” contexts (where participants were randomly exposed to aversive screams) and “safe” contexts. In an accompanying study (N = 59) we could show that such threat-of-scream conditions were associated with enhanced skin conductance level and subjective reports of anxiety. Results from classical and model-based analyses (from signal detection theory) indicate that threat contexts induced a bias to detect fear in faces with averted gaze, while no difference was observed for fearful displays with a direct gaze. Altogether, our findings suggest that when perceiver is experiencing a threat, social signals providing information about the location of a danger are prioritized.
Learning by observing others is highly adaptive, especially when it comes to learning about other people who might be dangerous. The extent to which vicariously acquired threat/safety associations can be modified by new observations is not well understood. To this end, 32 participants first viewed a learning video in which a demonstrator undergoes a differential threat/safety conditioning procedure with 4 neutral faces (2 female/male) serving as conditioned stimuli (CS+/CS−). Participants then completed the same experiment as the demonstrator in the video, however, CS+/CS− faces were displayed with happy and angry facial expressions (6 s each, with 10–15 s ITI), auditory startle probes were presented in two thirds of the trials (32 startle probes, 104 dB), and no electric shocks were applied. Preliminary results show that CS+ relative to CS− faces were perceived as more unpleasant, arousing, and threatening, and lead to pronounced startle reflex. In addition, startle reflex was more pronounced for male relative to female faces. Following, in a second video, contingencies were partially reversed in that each one CS+/CS− maintained cueing threat/safety, while the others changed from cueing threat to safety and vice versa. After reversal learning, threat effects persisted for ratings but decreased for startle reflex. However, threat-potentiated startle reflex occurred specifically for angry CS+ faces. Thus, vicariously learned threat and safety can be flexibly updated by new observations, and such reversal processes vary with facial information (gender and facial expressions).

**Funding:** This work was supported by the German Research Foundation (BU 3255/1-2).

**ACTION DECISIONS TO SOCIAL THREAT**

Julie Grézes, Rocco Mennella

PSL University

The ability to swiftly and accurately respond to others' non-verbal signals, such as their emotional expressions, constitutes one of the building blocks for social adaptation. It is debated whether rapid action tendencies to socio-emotional signals solely depend upon stimulus-evoked predecisional motor bias or can also engage goal-directed processes that involve the arbitration between action alternatives. Here, we tackle the contribution of goal-directed processes to emotional behaviours during free-choice tasks. In a first step, by using drift-diffusion models of choice and electroencephalography to investigate the impact of task-irrelevant threat-signalling individuals on spontaneous approach-avoidance decisions, we revealed that avoidance tendencies depend upon a rapid value-based competition between existing action plans. In a second step, we tested whether individuals can learn to choose actions that lead to desired motivational outcomes, i.e., avoiding individuals with threat displays. We showed that participants can use previous choices' outcomes to adapt value expectations, a core component of goal-directed behaviours, suggesting that the outcome of the preferred choice can act as a reinforcer for that choice. Overall, our results convincingly support the underestimated influence of implicit goal-directed mechanisms in approach-avoidance responses to socio-emotional signals.

**Funding:** National Institutes of Health
TRAIT ANXIETY HAMPERS THE DIFFERENTIATION BETWEEN THREAT AND SAFETY CONTEXT
Matthias Wieser1,2, Yannik Stegmann2, Marta Andreatta1,2, and Paul Pauli2
1Erasmus University Rotterdam, 2University of Wuerzburg

We investigated attention mechanisms in fear and anxiety by adapting the NPU-threat test to measure steady-state visual evoked potentials (ssVEPs) where no aversive (N), predictable aversive (P), and unpredictable aversive contexts (U) were signaled by four-object arrays. In addition, contextual cues were presented during all conditions but predictably signaled threat only during the P condition. Onset of the U compared to the P context elicited larger ssVEPs. Conversely, P cues elicited larger ssVEPs compared to N cues, which was also accompanied by an enhanced heart rate acceleration. Both P and U context yielded increased ssVEP amplitudes, with longer lasting effects in the U context. In a further study we employed the ssVEP-NPU paradigm in 29 low (LA) and 29 high (HA) trait-anxious participants. All participants allocated increased attentional resources to the central P-threat cue. Importantly, LA individuals exhibited larger ssVEP amplitudes to contextual threat (U and P) than to contextual safety cues, while HA individuals did not differentiate among contextual cues in general. Further, HA exhibited higher aversive ratings of all contexts compared to LA. These results suggest that high individuals might be worse at discriminating contextual threat stimuli and accordingly overestimate the probability and aversiveness of unpredictable threat. These findings support the notion of aberrant sensory processing of unpredictable threat in anxiety disorders, as this processing pattern is already evident in individuals at risk of these disorders.

Funding: DFG CRC58 B05

ANXIETY SENSITIVITY AS MEDIATOR FOR GENERALIZATION OF CONDITIONED ANXIETY
Marta Andreatta1,2, Dorothea Neueder2, Hannah Genheimer2, Matthias Wieser1,2, and Paul Pauli2
1Erasmus University Rotterdam, 2University of Wuerzburg

Anxiety patients overgeneralize fear responses, possibly because they cannot distinguish between cues never been associated with a threat (i.e., safe) and threat-associated cues. On the contrary, high anxious individuals showed discriminative responses between a safe context and a context, in which a threatening event was unpredictably delivered. Here, we investigate how anxiety sensitivity modulates contextual conditioned anxiety and its generalization processes. Fifty-five participants underwent a two-days VR context conditioning. On Day 1, aversive unconditioned stimuli (US) were unpredictably delivered in one virtual office (CTX+), but never in a second virtual office (CTX−). On Day 2, participants passively re-visited both CTX+ and CTX− as well as three additional virtual offices, which gradually resembled the CTX+ (from 25% to 75%). Successful acquisition of conditioned anxiety was indicated by aversive ratings and defensive physiological responses (i.e., SCR) to CTX+ versus CTX−. Generalization of conditioned anxiety was evident for ratings, but less clear for physiological responses. Importantly, anxiety sensitivity was positively correlated with the generalization of reported contextual anxiety. Thus, this study demonstrates generalization gradients for conditioned contextual anxiety and that anxiety sensitivity facilitates such generalization processes suggesting the importance of generalization of contextual anxiety for the development of anxiety disorders.

Funding: DFG CRC58 B01

OVERGENERALIZATION OF CONDITIONED FEAR IN PTSD CAN BE REDUCED WITH SUFFICIENT LEARNING TRIALS
Shmuel Lissek, Abbey Hammel, and Nathaniel Helwig
University of Minnesota, Twin Cities

One abnormality in posttraumatic stress disorder (PTSD) is heightened generalization of fear from a conditioned danger-cue (CS+) to similarly appearing safe cues. This work represents the first effort to track the time-course of heightened generalization in PTSD with the prediction of heightened PTSD-related over-generalization in earlier but not later trials. This prediction derives from past discriminative fear-conditioning studies providing evidence that over-generalization in PTSD may be reduced with sufficient learning trials. Presented findings derive from a re-analysis of previously published conditioned fear-generalization data (Kaczkurkin et al., 2017) including combat veterans with PTSD (n = 15), subthreshold PTSD (SubPTSD: n = 18), and trauma controls (TC: n = 19). This re-analysis aimed to identify the trial-by-trial course of group differences in generalization across three classes of safe generalization stimuli (GSs) parametrically varying in similarity to a CS+ paired with shock. Those with PTSD and SubPTSD, relative to TC, displayed significantly elevated generalization to all GSs combined in early but not late generalization trials. Additionally, over-generalization in PTSD and SubPTSD persisted across trials to a greater extent for classes of GSs bearing higher resemblance to CS+. Such results suggest that PTSD-related over-generalization of conditioned threat expectancies can be reduced with sufficient exposure to unreinforced GSs and accentuate the importance of analyzing trial-by-trial changes when assessing over-generalization in clinical populations.

Funding: NIMH grant MH-080130

RECOGNITION PROFICIENCY, IMPLICIT RACIAL BIAS, AND EARLY FACE-SENSITIVE ERP RESPONSES
Gizele Anzures and Melissa Mildort
Florida Atlantic University

Face stimuli has been found to elicit distinct P100, N170, and P200 event-related potential (ERP) responses (reviewed in Olivares et al., 2015 and Schweinberger & Neumann, 2016). However, the influence of face race on these early face-sensitive ERPs remains mixed (reviewed in Anzures & Mildort, 2021). We speculate that these mixed findings may be driven, at least in part, by individual differences in factors that likely affect other-race face perception. Such factors include other-race face recognition and racial bias. Thus here, we examine Caucasian adults’ face identity recognition proficiency and implicit racial bias in relation to early ERP responses to own-race Caucasian and other-race East Asian faces during a simple viewing task. Our results show overall differences in N170 and P200 responses to own-race compared to other-race faces. Most importantly, our results also show that differences in other-race recognition proficiency and implicit biases favoring one’s own race group can influence N170 and P200 responses to other-race faces. In addition, we will discuss face identity recognition proficiency and implicit racial bias in relation to early ERP responses within the context of different face processing task demands (e.g., ERP responses during a face race categorization task or a face identity processing task). Our findings highlight the importance of considering individual differences in identity recognition proficiency and racial bias when examining the early stages of own- and other-race face perception.

Funding: DFG CRC58 B01
ANGRY IN AMERICA: PSYCHOPHYSIOLOGICAL RESPONSES TO UNFAIR TREATMENT

Julian Thayer, Luca Carnevali, Andrea Sgoifo, and DeWayne Williams
University of California, Irvine

African Americans have the highest rates of hypertension-related disease of any other ethnic group in the United States. Importantly, racism and discrimination have been linked to these higher rates of morbidity and mortality. Discrimination is deleterious not only to those that are the recipients of this unfair treatment but also to the partners and family members of those affected as well to those that perpetrate this bias. In this talk we identify a unique pattern of psychophysiological response to unfair treatment we have called the "cardiovascular conundrum". This pattern is characterized by greater heart rate variability and greater total peripheral resistance in African Americans compared to their European American counterparts. We review the evidence supporting the existence of this pattern and propose several physiological and psychological comitants. We also propose a number of factors that might help to mitigate the deleterious effects associated with it. Whereas the context of the current review is on Black/White disparities we further report that this pattern may be present in others exposed to unfair treatment. Ultimately, the systemic factors that perpetuate these inequalities will require that we first acknowledge and then face the challenges they present if we are to address the health disparities in our country.

STUDYING DYNAMIC EMOTION PROCESSING DISRUPTIONS IN PSYCHIATRIC DISORDER: A RESEARCH FRAMEWORK THAT IMPROVES TRANSLATION TO CLINICAL IMPACT

Session Chairs: Christopher Sege \(^1\) and Evan White \(^2\)
\(^1\)Medical University of South Carolina, \(^2\)Laureate Institute for Brain Research

Discussant: Lisa McTeague
Medical University of South Carolina

Descriptors: Psychopathology, Emotion, Psychophysiology

Emotion is built on basic motivational systems whose operation varies across contexts, and it is increasingly recognized that this context sensitivity must be accounted for in the treatment of emotion processing disruptions in psychiatric disorder. To better treat context-sensitive emotion systems, translational studies upon which treatment development is based must strive for the same dynamic ecological validity as is found in the foundational animal work. To support this, this symposium articulates principles of human research that captures the dynamic validity of animal work and leverages it to create better tools for targeting psychiatric emotional disruptions. Two principles—iterative experimental context manipulation and multi-modal measurement—are emphasized, and Evan White first details these principles by reviewing studies that manipulate a well-characterized emotion perception context and, with multiple measures, reveal context-specific activation shifts and clinical disruptions. Next, Drs. Sege, Taylor, and Valadez report novel multi-modal physiology data showing how clinical anxiety and depression affect dynamic system operation across: (1) avoidance versus escape contexts; (2) dual task contexts; and; (3) reward versus reinforcement learning contexts. Finally, Lisa McTeague integrates the data to show how a dynamic system framework can support the development of better tools for targeting emotional processing in the clinic—with a particular emphasis on improving treatment generalizability and sustainability through a focus on holistic emotional system functionality.
PICTURE VIEWING AS A TEMPLATE FOR A DYNAMIC SYSTEMS APPROACH TO INVESTIGATING DISRUPTED EMOTIONAL PROCESSING

Evan White, Christopher Sege, and DeMond Grant
1Laureate Institute for Brain Research, 2Medical University of South Carolina, 3Oklahoma State University

Disrupted emotional processing is ubiquitous across psychiatric disorders. Empirical work has identified punctate processing deficits in specific contexts that are associated with discrete clinical phenomena (e.g., fear reactivity in phobics, error monitoring in anxious perfectionists, blunted reward anticipation in depressed individuals). However, specific task effects may reflect both the uniformity and dynamism of the broader emotional processing system. This talk details a dynamic systems approach to examining emotional processing in psychopathology wherein systematic empirical modulations of multimodal responding provide functional biomarkers of processing deficits. Modified picture viewing studies are presented as a template for the conceptual framework. Data show that the well-established increase in electrocortical measures of attention by threatening pictures is reduced but not under cognitive load, indicating that context differentially impacts threat processing dimensions. In addition, clinical worry counteracts the ERPs reflected action preparation (modulation was similar for avoidance and escape preparation) but it moderated startle reactivity p = .02. Together, data suggest context- and processing dysfunction at the individual level.

Funding: No funding was received to collect data presented in this talk. Evan White is supported by a career development award from the National Institute on Minority Health and Health Disparities (NIMHD K99MD015736).

INDIVIDUAL DIFFERENCES IN ERROR MONITORING AFTER CONDITIONED CONTEXTUAL THREAT

Danielle Taylor, Jacob Kraft, Kristen Frosio, Danielle Deros, Kaitlyn Nagel, and DeMond Grant
1Ralph H. Johnson VA Medical Center, 2Oklahoma State University, 3Michael E. DeBakey VA Medical Center

Error monitoring is exaggerated by worry and threat. Studies demonstrate that error-related negativity (ERN) is modulated under either task-concurrent performance-related threat or task-preceding performance-relevant threat (Kiesel et al., 2011; White et al., 2018). The goal of this study was to assess how ERN is influenced by performance-independent but task-concurrent threat among worriers with data from our previous study evaluating contextual conditioning (Taylor et al., 2020). High (HW) and low worriers (LW; Behar et al., 2003) completed a contextual conditioning task: a large versus small circle was paired with white noise bursts when presented in a black versus gray context. A flanker task, in which trials appeared in gray or black context, was completed pre- and post-conditioning. Standardized ERN residuals were entered in a 2 Time × 2 Context × 2 Worry Group ANOVA, showing a Time × Worry Group interaction, p = .02, such that HWs had smaller pre-conditioning ERN scores compared to LWs, p = .02, in support of literature suggesting the ERN-worry link is specific to specific clinical populations (Härpfer et al., 2020; Saunders & Inzlicht, 2020). HWs also showed pre-to-post-conditioning ERN enhancements, p = .04, without differentiation between context, suggesting fear overgeneralization (Lissek et al., 2009). Environmental threat irrelevant to performance augments reactivity among worriers, distracting from already inefficient error monitoring. These and our previous data provide evidence for sustained modulation of executive functions as a result of conditioned threat.

ELECTROPHYSIOLOGICAL MEASURES OF REWARD SENSITIVITY IN GAMBLING AND NON-GAMBLING CONTEXTS

Emilio Valadez and Robert Simons
1University of Maryland, College Park, 2University of Delaware

Biomarkers of reward sensitivity may inform depression assessment and improve treatment recommendations. Efforts to characterize event-related potentials (ERPs) in response to reward and nonreward feedback during gambling tasks reveal a positive voltage deflection in response to rewards (i.e., the reward positivity or “RewP”) that is attenuated following nonrewards and negatively associated with risk for depression. However, it remains unclear whether the RewP is also elicited in non-gambling contexts. Thus, the current study compared feedback ERPs elicited by gambling and non-gambling tasks to examine the generalizability of the RewP across contexts. Sixty-seven young adults completed a Doors mock-gambling task and a reinforcement learning task during a single laboratory session. Both tasks included positive feedback indicating monetary rewards and negative feedback indicating monetary losses. Principal components analysis of feedback ERPs revealed that whereas ERPs elicited by the Doors mock-gambling task were driven by the RewP, ERPs elicited by the reinforcement learning task were instead driven by a negativity following loss feedback that was attenuated following reward feedback. ERP amplitude correlations across tasks were relatively low (rewards: r = .35; losses: r = .31) and ERPs from each task had differentiable associations with self-reported negative affect and reward responsiveness. Findings suggest that these two feedback tasks likely do not yield exchangeable measures of reward sensitivity and that the RewP may be specific to gambling contexts.
Session Chair: David Cole
Ausblick Therapie
Discussant: David Cole
Ausblick Therapie

Descriptors: Beta Bursts, Gamma Bursts, Motor Control

Brainwaves are classically modeled as sustained rhythms. Yet, in the beta–gamma range, raw traces reveal them to occur in bursts of a few cycles. Sustained rhythms may only emerge as an artifact of averaging hundreds of bursts across seconds of spectrograms. As such, standard analyses risk discarding plausible signals like burst count, duration, and temporal locus. These are the conclusions of dozens of papers concentrated in the past few years. In this transnational symposium, four researchers in the vanguard will describe how they are rethinking brainwaves. First, Dr. Torrecillos extracted beta bursts from local field potentials in subthalamic nuclei. Parkinsonian movement velocity, she will report, is predicted by parameters like burst timing that are obscured by typical analyses. Second, Dr. Bonaiuto extracted beta bursts using MEG. Supporting a rapid, functional role for sensorimotor bursts, he will show that they temporally predict the confluence of excitatory drives in superficial and deep cortical layers. Third, Dr. Wessel originally analyzed beta bursts in healthy humans using EEG. He will describe a tight choreography of fronto-central bursts modulating sensorimotor bursts modulating motor inhibition. Finally, Dr. Longin and colleague computationally modeled how inhibitory-excitatory networks can generate gamma and other bursts. He will show how two meta-parameters can explain a range of burst statistics, including in vivo observations. Discussion will focus on untapped potential of burst analyses as well as barriers to their maturation into a default technology.

Funding: Support for the chair and discussant was provided by the Society for Psychophysiological Research and the National Institutes of Health.

DYNAMIC MODULATION OF SUBTHALAMIC BETA BURSTS AND MOTOR PERFORMANCE

Flavie Torrecillos
University of Oxford

Considerable evidence suggests a role of beta-band oscillations in voluntary movements and recently, emphasis has been placed on the transience of beta activity. However, it remains unclear if beta bursts modify motor performance, and if so how? To this end, we recorded, in three complementary studies, local field potentials from the subthalamic nucleus (STN) of patients with Parkinson's disease (PD) while they performed ballistic movements. First, motor behaviour was normalized as far as possible with levodopa treatment, and beta bursts were defined offline as periods exceeding the 75th percentile amplitude threshold. We found that beta bursts in the contralateral STN in a time-limited window well before movement onset slowed down that movement. Second, PD patients OFF medication performed a new version of the task, in which the visual cues were triggered in real time by bursts of STN beta activity. The results strengthen the link between STN beta bursts and movement velocity. Importantly, they also showed that the presence of multiple bursts was an additional factor slowing movement, suggesting a cumulative effect of beta bursts. Third, the effect of medication was directly tested within patient. The results revealed that levodopa treatment may modify associations between beta bursts and movement velocity, helping to explain drug-related changes in motor performance. Together, these results offer new insight in the pathology of PD and suggest that modulation of beta bursts might dynamically modify motor performance, with this function being under dopaminergic influence.

Funding: Support for this research was provided by the Medical Research Council, the Rosetrees Trust, the NIHR Oxford Biomedical Research Centre, and the Swiss Parkinson Association.

Differential Inputs to Deep and Superficial Lamina Drive Beta Bursts in Human Motor Cortex

James Bonaiuto
Le Centre National de la Recherche Scientifique

Modulation of motor cortical activity in the beta frequency band is one of the strongest and most studied movement-related neural signals. A substantial proportion of sensorimotor beta activity occurs in discrete transient bursts rather than as oscillations. It is becoming increasingly clear that cortical beta bursts have an active, information-encoding role in movement. Prominent computational neural models of sensorimotor beta bursts predict that they are generated by the confluence of two excitatory synaptic drives: a strong, brief input to superficial cortical layers, temporally aligned with a broad, weaker input to deep layers. I will present recent developments in high precision MEG which, combined with biophysically principled neural modeling, yield a temporally resolved estimate of the relative strength of superficial and deep cortical layer activity. We applied this analysis to human MEG data, showing that the laminar profile of both pre- and post-movement beta bursts in motor cortex matched the biophysical model's predictions: activity surrounding the beta burst peak localized to deep cortical layers, whereas the peak corresponded to activity predominantly in superficial layers. These results thus validate the predictions of the biophysical model in human motor cortex and support a rapid and dynamic functional role for sensorimotor beta bursts.

Funding: Support for this research was provided by the European Research Council.

The Effects of Proactive and Reactive Inhibitory Control on Sensorimotor and Fronto-Central Beta-Bursts in Healthy Humans

Jan Wessel
University of Iowa

Local field potential activity in the beta frequency-band is a fundamental signature of motor system activity. While beta-activity is classically conceptualized in terms of steady amplitude changes that span several hundreds of milliseconds (e.g., sensorimotor beta-desynchronization during movement initiation), recent studies have demonstrated that beta is more accurately described in terms of short-lasting, transient, burst-like events. In a large-scale EEG study of the stop-signal task ($N=234$), we found that such beta-bursts relate to the inhibition of the motor system. Specifically, at the beginning of each trial, steady beta-bursting was evident over sensorimotor areas. During movement initiation, these sensorimotor beta-bursts steadily declined, the rate of which predicted reaction times. Conversely, after Stop-signals, a phasic increase in fronto-central beta-bursts was evident, followed by a reinstatement of sensorimotor beta-bursting. These findings suggest that sensorimotor beta-bursts could reflect a steady inhibition of the motor system at baseline (proactive inhibition), whereas fronto-central beta-bursts could confer a rapid reinstatement of inhibition (reactive inhibition). To test this proposition directly, we present data from two experiments that operationalize proactive inhibition (comparing Go-responses made with/without the anticipation of a Stop-signal) and reactive inhibition (investigating activity after unexpected perceptual events that invoke motor inhibition), while we measured sensorimotor and fronto-central beta-bursts using scalp EEG.

Funding: Support for this research was provided by the National Institutes of Health and National Science Foundation.
Bursts in gamma and other frequency ranges are thought to contribute to the efficiency of working memory or communication tasks. Abnormalities in bursts have also been associated with motor and psychiatric disorders. The determinants of burst generation are not known, specifically how single cell and connectivity parameters influence burst statistics and the corresponding brain states. We present a generic mathematical model for burst generation in an excitatory-inhibitory (EI) network with self-coupling often referred to as the Pyramidal Interneuron Network Gamma (PING) type. The resulting equations for the stochastic phase and envelope of the rhythm’s fluctuations are shown to depend on only two meta-parameters that combine all the network parameters. They allow us to identify different regimes of amplitude excursions, and to highlight the supportive role that network finite-size effects and noisy inputs to the EI network can have. We discuss how burst attributes, such as their durations and peak frequency content, depend on the network parameters. The model can mimic the behavior of some types of amplitude modulations of gamma band activity observed in previous studies. Furthermore, it suggests an optimal network parameter range where the burst statistics are similar to those seen in vivo. Our approach can be extended to different frequency bands and to more complex coupled networks. We further report on a method for fitting the model to actual recordings from macaques, thereby yielding a personalized envelope-phase description with which to study rhythm bursts.

**Funding:** Support for this research was provided by NSERC Canada.

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**Symposium 2.3**

**DAVID SHAPIRO: HIS LIFE, LEGACY, AND INFLUENCE ON PSYCHOPHYSIOLOGY**

Session Chair: Julian F. Thayer
University of California, Irvine

David Shapiro, a giant in the field of psychophysiology and behavioral medicine, died peacefully at his home on February 3, 2020 at the age of 96. David Shapiro was Editor in Chief of *Psychophysiology* from 1978 to 1986, served as president of the Society for Psychophysiological Research (SPR) in 1975–1976 (Shapiro, 1977), and received SPR’s Distinguished Career Contribution Award in 1988 (Tursky, 1988). His body of research has also been honored by the Society of Behavioral Medicine, American Psychosomatic Society, and the Society of Applied Psychophysiology and Biofeedback. He is survived by his life-long companion, Shirley, whom he was married for 68 years. This symposium features three researchers that have had a long-standing relationship with Dr. Shapiro. Paul Lehrer was a student of Dr. Shapiro’s at Harvard and will discuss their pioneering contributions to biofeedback. Cristina Ottaviani was a close collaborator of Dr. Shapiro’s at UCLA and will discuss their pioneering work on ambulatory recording and ecological momentary assessments. Dr. Thayer was a colleague and friend of Dr. Shapiro’s and will discuss his pioneering work on ethnic differences and health disparities. David Shapiro’s contributions to our Society have influenced generations of researchers and he is dearly missed.

**A REVIEW OF HEART RATE VARIABILITY BIOFEEDBACK STUDIES**

Paul Lehrer
Robert Wood Johnson Medical School, Rutgers University

**PIONEERING THE COMBINATION OF AMBULATORY PHYSIOLOGY WITH ECOLOGICAL MOMENTARY ASSESSMENT: FROM PAPER AND PENCIL TO ELECTRONIC DIARIES**

Cristina Ottaviani
Sapienza University of Rome

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**Symposium 3.1**

**ETHNIC DIFFERENCES IN BLOOD PRESSURE: THE ROLE OF VASCULAR FUNCTION**

Julian F. Thayer
University of California, Irvine

**ANXIETY, WORKING MEMORY, AND ATTENTIONAL CONTROL: THE NEURAL AND BIOLOGICAL MECHANISMS INSTANTIATING THIS COMPLEX INTERACTION**

Session Chairs: Richard Ward and Christine Larson
University of Wisconsin, Milwaukee

**Descriptors:** Attention, Working Memory, Anxiety

Research indicates that anxiety can adversely impact working memory and attentional control processes. Here, we discuss conditions in which anxiety negatively impacts working memory and attentional control, the neural and biological mechanisms reflecting this effect, and the impact this interaction has for health and chronic illness. Ward and colleagues will begin by demonstrating conditions in which anxiety does, or does not, impact working memory capacity and the unnecessary storage of task-irrelevant distracters. Next, Stout and colleagues will provide evidence showing that negative information stored in working memory affects frontoparietal systems supporting top-down cognitive control. Balderston and colleagues will then present data highlighting the potential causal role of right DLPFC in anxiety. Moser and colleagues will discuss work showing that estradiol may serve as a biological mechanism underlying working memory performance, particularly for those with high levels of worry. Finally, Derakshan and colleagues will focus on cognitive and emotional vulnerability in women with breast cancer, and discuss neural markers of attentional control reflecting this relationship. Together, these findings demonstrate the complex interaction between anxiety, working memory and cognitive control, highlighting the underlying neurobiological mechanisms facilitating anxiety’s impact on these processes, and the influence this has on health.

**THE EFFECTS OF ANXIETY ON WORKING MEMORY AND UNNECESSARY STORAGE OF DISTRACTERS**

Richard Ward1, Salahadin Lotfi1, Daniel Stout2,3, Han-Joo Lee1, and Christine Larson1

1University of Wisconsin, Milwaukee, 2University of California, San Diego, 3VA San Diego Healthcare System

Prominent theories propose anxiety restricts working memory capacity and impairs the ability to filter task-irrelevant information. We present findings filling two important gaps in this literature. First, we discuss how an anxious state impacts these processes. Second, we examine attentional capture and unnecessary working memory storage for threatening distracters from a less studied stimulus modality—words. We address these questions using the contralateral delay activity (CDA) to index working memory capacity and unnecessary storage of distracters, and N2pc to assess attentional capture of threatening distracter words. Our first study (*n* = 60) measured CDA amplitudes while participants completed a change detection task under two conditions: threat of shock and safe. We found a reduced CDA for large loads in the threat of shock compared to safe condition, but no differences in unnecessary storage of neutral distracters between conditions. The second study (*n* = 60) also used the CDA to index whether threatening distracter words were unnecessarily stored in working memory, and the N2pc to assess if these words induced attentional capture. Analyses revealed no differences in attentional capture or unnecessary storage for threatening versus neutral distracter words. We’ll discuss how our findings inform specific circumstances in which anxiety may impact working memory maintenance and unnecessary storage of neutral distracters, and the influence of salient stimulus modalities, such as threatening words, on attentional capture and unnecessary storage in working memory.
MAINTAINING NEGATIVE INFORMATION IN WORKING MEMORY MODULATES FRONTOPIARIETAL ACTIVITY DURING AVERSIVE ANTICIPATION

Daniel Stout1,2, Jessica Bomyea1,2, Victoria Risbrough1,2, and Alan Simmons1,2
1University of California, San Diego, 2VA San Diego Healthcare System

The ability to down-regulate anxious anticipation is key for emotion regulation and maintaining goal-related behavior. Previous research has found that placing high demands on working memory (WM) increases frontoparietal activity and attenuates amygdala-driven reactivity while anticipating aversive stimuli. However, the neural mechanisms associated with maintaining negative information in WM while anticipating aversive stimuli remains poorly understood. In the current investigation, healthy adults (n = 24) completed a well-validated aversive anticipation task while maintaining a variable number of negative or positive words in WM while undergoing functional magnetic resonance imaging (fMRI). A whole-brain analysis revealed significant clusters in the dorsolateral prefrontal cortex (dIPFC) and the posterior parietal cortex (PPC). When anticipating negative words, there was a decrease in neural activity in the dIPFC and the PPC when maintaining negative words in WM compared to the other conditions. At low WM load, amygdala activity during anticipation was higher when maintaining negative words in WM compared to positive words, but not at high loads. Planned comparisons revealed that when maintaining negative words in WM and anticipating a negative image, amygdala activity was significantly lower at high load compared to low load. In sum, these findings demonstrate that the affective valence of the items stored in WM modulates top-down control networks necessary for the execution of cognitive control and emotion regulation.

THE RIGHT DLPFC PLAYS A MECANISTIC ROLE IN THE INTERACTION BETWEEN ANXIETY AND COGNITION

Nicholas Balderston1, Monique Ernst2, and Christian Grillon2
1University of Pennsylvania, 2National Institutes of Health

The dorsolateral prefrontal cortex (dIPFC) is a critical region for focusing attention and retaining items in working memory (WM), both tasks that anxiety patients struggle with. However, it is also thought that a hyperactive right dIPFC may contribute to anxiety symptoms. Understanding these distinct, arguably conflicting roles of this region is critical for understanding this class of disorders. In this talk, I will present data from two recent experiences exploring (1) WM-related dIPFC activity in anxiety patients and healthy controls, and (2) the effects of targeting the right dIPFC with repetitive transcranial magnetic stimulation (rTMS) on anxiety in healthy controls. For the first study, we used the Sternberg WM paradigm to assess dIPFC activity while subjects either maintained or manipulated a letter series in WM. Using this approach, we showed differential patterns of left and right dIPFC activity for patients and controls, with patients exhibiting bilateral dIPFC activity compared to the left-centered activity exhibited by the healthy control subjects. For the second study, we targeted the right dIPFC with 10 Hz rTMS, and measured anxiety potentiated startle before and after stimulation. Using this approach, we showed that stimulating the right dIPFC increases anxiety. Together, these results suggest a direct causal link between right dIPFC functioning and anxiety/cognition interactions. One possibility is that anxiety patients over-rely on their right dIPFC and that this over-reliance leads to increases in anxiety expression.

ASSOCIATIONS BETWEEN WORRY AND VERBAL WORKING MEMORY ARE DEPENDENT ON ESTRADIOL

Jason S. Moser and Lillianne M. Gloe
Michigan State University

Worry is a component of anxiety characterized by future-oriented repetitive negative thought. Theory and research indicate that worry co-opts working memory resources that would otherwise be allocated to task-relevant stimuli thereby rendering cognitive function inefficient (slower) or ineffective (less accurate) depending on difficulty. What is missing from such cognitive accounts of anxiety, however, is inclusion of biological mechanisms that may play an important role in the interplay between anxiety and cognition. We contend that ovarian hormones are one particularly important biological mechanism to consider. We focus on estradiol because (1) anxiety, and worry, in particular, tends to be more prominent in females, who have higher levels of estradiol than males, (2) estradiol influences anxiety symptoms and (3) estradiol modulates frontal control systems involved in working memory function. Based on previous research, we predicted that worry would be related to more ineffective working memory performance when both difficulty and estradiol levels were high. 102 naturally-cycling females provided saliva and completed measures of worry and verbal working memory four times across their menstrual cycles. Results confirmed our hypothesis such that estradiol was associated with poorer accuracy on more difficult verbal working memory trials when worry levels were also high. Findings further indicated that working memory performance was negatively impacted by chronically elevated levels of worry and estradiol and not by transient changes in either across the cycle.

ERROR-RELATED NEGATIVITY AND ITS RELATIONSHIP WITH ANXIETY IN BRANCE CANCER: IMPLICATION FOR TARGETING ATTENTIONAL CONTROL

Nazanin Derakhshan1, Bethany Chapman1, Jessica Swainston1, Courtney Louis2, and Jason Moser3
1Birkbeck University, London, 2Michigan State University

Breast cancer is the biggest cause of malignancy in women, with an increasing rise especially in younger women. Medical advances have enabled longevity but the cognitive and emotional cost of diagnosis and treatment side effects continue to impair executive function increasing the risk of anxiety and depression, heavily impairing quality of life in survivors. Behaviourally, we have shown that cognitive vulnerability in breast cancer can explain emotional vulnerability (Chapman et al., 2019) and that it is possible to reduce anxiety and depression in this population (Swainston & Derakhshan, 2018) through targeting attentional control. The focus of this talk is on the neural mechanisms of cognitive and emotional vulnerability in breast cancer which are yet to be established. This talk will present new evidence on the utility of the ERN in explaining elevated anxiety and depressive symptomatology in women with breast cancer, and its relationship with working memory impairments. It will further elucidate how the ERN can help understand the nature of compensatory effort often seen in such women, masking behavioural differences with healthy controls when achieving task goals. This is attributed to impaired processing efficiency as a result of treatment and diagnosis. Our results have specific implications for restoring workability and self-confidence, which are often reduced for long periods of time after active treatment, by targeting the ERN through adaptive cognitive training, and empowering longer-term resilience in women with breast cancer.
Background: Theories of suicide posit that suicidal ideation (SI) serve as negative reinforcement for distress, which may suggest that individuals who develop SI are more sensitive to negative reinforcement cues. However, research focused on reward responding in suicide has focused only on sensitivity to positive reinforcement cues (e.g., winning money) rather than negative reinforcement (e.g., avoiding distress). Methods: Participants (n = 96) completed a doors task with two alternating conditions. In the positive reinforcement condition, participants chose one of two doors and then viewed feedback indicating that they either won or lost money. In the negative reinforcement condition, feedback represented a pending aversive noise (i.e., punishment) or avoidance of the aversive noise (i.e., safety). Time-frequency components representing the reward-related delta for winning money relative to loss (Δapositive reinforcement delta; ΔPR delta) and safety relative to punishment (Δnegative reinforcement delta; ΔNR delta) were extracted. Results: ΔNR delta was larger among those with elevated SI (β = .33, p = .014) and blunted among those with a history of SAs (β = −.27, p = .008). No significant differences emerged for ΔPR delta (p > .74). Discussion: Greater SI was associated with more sensitivity to safety signals. This finding builds on theoretical perspectives of the role of negative reinforcement in SI and demonstrated specificity of SI and SA to valence-specific reward-related abnormalities.

Session Chairs: Greg Hajcak and Thomas Joiner
Florida State University

Discussant: Greg Hajcak
Florida State University

Descriptors: Suicide, ERPs, fMRI

Using neuroimaging and event-related potentials (ERPs) to study suicidal thoughts and behaviors (STBs) is a relatively new area. For example, the first study that used fMRI to search for individual differences in those experiencing STBs was only published a little over a decade ago. Since then, hundreds of studies have examined many different neural functions and how they may relate to STBs, with inconsistent results. The talks in this symposium reflect this inconsistency across different stages of development (i.e., adults and children), measurements of neural functioning (i.e., fMRI and ERPs), and categories of STBs (e.g., suicidal ideation, and suicide attempt history). Pegg and Kajawa report that a decreased reward sensitivity, an ERP reflecting reward sensitivity, predicted history of STBs. On the other hand, Gallier and colleagues' analyses found that there was moderately more evidence that there is no relationship between STBs and four different ERPs, than that there is a relationship. Albanese & Schmidt present data on a novel negative reinforcement task and found a relationship between the neural response to negative reinforcement and both suicidal ideation and suicide attempt history. Last, Vidal-Ribas and colleagues report results from a large sample of children where they found no evidence for any differences in neural functioning in children with STBs using fMRI. Together, these studies highlight the complexity of STBs and point toward the need for further research to understand this complexity.

REWARD SENSITIVITY ABNORMALITIES IN SUICIDAL THOUGHTS AND BEHAVIORS: THE IMPORTANCE OF REINFORCEMENT VALENCE

Brian Albanese1 and Norman Schmidt2
1Auburn University, 2Florida State University

Objective: Suicide deaths and suicidal thoughts and behaviors (STBs) are considered a public health emergency, yet their underpinnings in the brain remain elusive, especially in prepubertal children and non-clinical samples. Methods: Children ages 9–10 years (N = 7,994, females, 47.0%) from a population-based sample from the ABCD study were assessed for lifetime STBs, and psychosocial factors. Structural MRI, resting-state functional MRI, and task-based functional MRI were examined. Differences in neural correlates were examined with Welch’s t-test and equivalence tests, with smaller effect size of interest of [0.15]. Classification accuracy was examined with area under precision-recall curves (AUPRCs). Results: Children with lifetime STBs based on child (8.6%), and caregiver (8.2%) reports had higher levels of social adversity and psychopathology, among themselves and their caregivers, compared with never-suicidal children (85.7%). Only one imaging test survived statistical correction: caregiver-reported STBs were associated with a thinner left bank of the superior temporal sulcus. Based on the prespecified bounds of [0.15], approximately 48% of the group mean differences for child-reported STBs comparisons and 22% for caregiver-reported STBs comparisons were considered equivalent. All observed effect sizes were relatively small (d ≤ 0.30), and both non-imaging and imaging correlates had low classification accuracy (AUPRC ≤ 0.10). Conclusions: Commonly applied neuroimaging measures did not reveal a discrete brain signature related to suicidal thoughts and behaviors in youths.

Funding: NIH Intramural Research Program

NEUROPHYSIOLOGICAL RESPONSE TO REWARD AND SUICIDALITY IN ADOLESCENTS

Samantha Pegg and Autumn Kujawa
Vanderbilt University

Suicidality in youth is a global public health concern and has been associated with alterations in reward-related decision making. However, little is known regarding the extent to which reward responsiveness measures can differentiate clinically depressed adolescent populations with and without suicidality. In the present study, we tested whether self-report and neurophysiological measures of reward responsiveness improve classification of suicidality beyond demographic and clinical variables in a sample of depressed adolescents. Fifty-eight adolescents completed a guessing reward task while electroencephalogram data were recorded to measure event-related potentials in response to monetary feedback (i.e., reward positivity; RewP). Participants also completed the Behavioral Activation System self-report measure. Results of a logistic regression revealed that active suicidality in the sample was associated with both self-reported reward responsiveness and RewP. Further, more positive neural response to reward and a more negative response to loss feedback significantly predicted active suicidality beyond demographic, clinical, and self-report measures of reward responsiveness. Results support the clinical utility of neurophysiological measures in identifying depressed adolescents with active suicidality and the potential for heterogeneity of reward responsiveness in depression. Additionally, preliminary data examining predictors of change in suicidality in a sample of adolescents following discharge from inpatient and partial hospitalization will be presented.

Funding: This work was supported by a Klingenstein Third Generation Foundation fellowship (awarded to Dr. Autumn Kujawa), the Brain & Behavior Research Foundation Katherine Deschner Family Young Investigator grant (awarded to Dr. Kujawa), and institutional support from UL1 TR000445 from NCATS/NIH. Ms. Samantha Pegg was supported by NIH/NIMH T32-MH018921.
ARE THERE NEURAL DIFFERENCES BETWEEN THOSE WITH SUICIDAL thoughts and BEHAVIORS and NON-SUICIDAL CONTROLS? AN EXAMINATION OF THE REWp, LPP, ERN, and P300 IN DEPRESSION

Austin Gallyer¹, Nicholas Santopetro¹, Marielle Gomez¹, Julia Klawohn¹, Thomas Joiner¹, and Greg Hajcak¹
¹Florida State University, ²Humboldt-Universität zu Berlin

Suicide has been theorized to be the result of differences in neural functioning. In recent years, using event-related potentials (ERPs) to study the neurobiology of suicide has gained attention. We conducted a study that is exemplary of the methods used in this area to examine whether those experiencing suicidal thoughts and behaviors (STBs) demonstrate functional neural differences in four different ERPs. A sample of 123 community adults with a current depressive disorder was collected. Clinical interviews determined that 45 endorsed current suicidal ideation (SI) and 78 denied current SI. Participants completed the flankers task, doors task, and a passive picture-viewing task to measure four ERPs: the reward positivity, late positive potential, error-related negativity, and the P300. We conducted Bayesian t-tests comparing SI and no-SI groups using an informed normal distribution prior on all four ERPs. We also reran these analyses grouping participants with any STBs (e.g., SI, suicide plan) versus those without any STBs. Analyses revealed that for each of the ERPs and STBs group combinations, that there was about three times more evidence that there is no effect than that there is an effect. In other words, our analyses found more evidence for the null hypothesis than the alternative hypothesis (i.e., BF10 = 0.259–0.400). Our results suggest that within the methodological limits of this study, that there are no functional neural differences in ERPs in those experiencing STBs. Suggestions for building on this study and improving future work will also be presented.

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Symposium 4.1

FUNCTIONAL CORRELATES OF THE STIMULUS-PREcedING NEGATIVITY (SPN)

Session Chairs: Steven Hackley¹ and Ya Zheng²
¹University of Missouri, Columbia, ²Dalian Medical University

Descriptors: Attention, Reward Anticipation, Reinforcement Learning. The negative slow-wave that develops prior to motivationally relevant stimuli has proven useful in diverse lines of research, including reinforcement learning. Given that several distinct cortical regions contribute to the Stimulus-Preceding Negativity (SPN), this component may index multiple cognitive and affective processes. The studies to be reported in this symposium seek to identify some of these processes. Dr. Kotani will show how decomposition of the SPN via principal component analysis can reveal topographically specific aspects of anticipatory attention. Dr. Zheng will present evidence that two functional aspects of the dopaminergic reward system—effort expenditure and reward prediction—interact to determine SPN amplitude. Dr. Hackley will propose that subcomponents of this slow wave reflect retention in memory of recent actions and their predicted outcomes. Dr. Hiroa will report fMRI and ERP data to argue that anterior insular cortex contributes to the effect of agency on the SPN.

STIMULUS MODALITY AND CONTENTS DIFFERENTLY AFFECT SPN CORTICAL DISTRIBUTIONS AND COMPONENTS

Yasunori Kotani¹, Yoshimi Ohgami¹, Nobukiyo Yushida³, Akira Kunimatsu¹, Shigeru Kiryu¹, and Yusuke Inoue¹
¹Tokyo Institute of Technology, ²University of Tokyo, ³International University of Health and Welfare, ⁴Kitasato University

It is well known that the SPN amplitude is increased by anticipation of monetary reward. However, the SPN is also affected by properties of the anticipated stimulus like stimulus modality or contents. For example, the SPN amplitudes around the central to occipital sites are increased by anticipation of a visual stimulus; on the other hand, an auditory stimulus activates SPN around frontal regions. In our studies, we manipulated contents of visual stimuli (face, word, sign) and auditory stimuli (voice, rhythm, beep) to investigate the effect of contents of anticipated stimulus on the SPN. We measured EEG and conducted a principal component analysis (PCA) on the SPN. The PCA revealed that the SPN consists of two components: the early SPN and the late SPN. Statistical analyses on the early and late SPNs showed that the anticipation of face and voice stimuli increased the amplitude of the early SPN. On the other hand, sign and beep stimuli showed the right hemisphere preponderance of the late SPN while there was no right hemisphere laterality of the late SPN in the word condition. The anticipation of the rhythm stimulus decreased the amplitude of the late SPN. These results indicate that modality and contents of the anticipated stimulus affect components and the right hemisphere preponderance of the SPN. If we further elucidate the effect of stimulus properties on the SPN, we might be able to estimate what the person is expecting, and use the SPN as an index of the brain-machine interface for patients with disabilities.

DECOMPOSING THE EFFORT PARADOX DURING REWARD ANTICIPATION

Ya Zheng and Mang Zhang
Dalian Medical University

Descriptors: SPN, CNV, Effort Expenditure, Reward Anticipation. Effort expenditure not only discounts the reward associated with it but also adds the subjective value of reward and even is experienced as rewarding in its own right, which is known as the effort paradox. The current event-related potential (ERP) study examined the neural dynamics underlying the effect of effort expenditure on reward anticipation, which is indexed by three anticipatory ERP components: the cue-P3, the contingent negative variation (CNV) and the stimulus-preceding negativity (SPN). A sample of 32 participants performed a modified monetary incentive delay task in which effort expenditure (high vs. low) and reward prospect (reward vs. neutral) were combined in a factorial design. Results showed that reward prospect was encoded by the three anticipatory ERP components such that reward trials elicited greater ERP amplitudes than neutral trials. However, these reward-related ERPs exhibited the effort paradox in different ways: whereas the CNV was discounted by effort expenditure, the SPN was enhanced by effort expenditure. Our results suggest that the two main functions of the dopamine system, reward anticipation and effort expenditure, may be integrated in a complicated way during the anticipatory stage.

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A predictive coding framework can encompass several processes believed to underlie reinforcement learning, including motor control, reward prediction, and estimating the degree to which sensory events are a consequence of our own behavior. Some of the relevant outcome predictions might be held in working memory along with representations of recent actions as feedback is awaited. If subcomponents of the stimulus-preceding negativity (SPN) reflect retention or real-time adjustments of these representations, its amplitude should vary over the course of learning. In a study of 66 young adults, we showed that during feedback-based learning of a motor skill (serial keypresses of specified durations) there was a decline in SPN amplitude that was absent or reversed at posterior sites. Diminution of SPN amplitude was limited to the first half of the 6-s pre-feedback delay and was accompanied by modulation of theta power. More specifically, theta activity at sites overlying sensorimotor cortex on the side contralateral to the just-completed action diminished as the task was learned. As in our previous, similar study (Ren, Valle-Inclán, Tukaev, and Hackley, 2017), we observed a reverse-polarity lateralized readiness potential (LRP) at the conclusion of the delay that did not vary in amplitude across trials. These data suggest that retention in memory of recent actions and their predicted sensory consequences may be evident in topographically specific subcomponents of the SPN and accompanying spectral perturbations.

THE EFFECT OF SENSE OF AGENCY ON ACTIVITY OF ANTERIOR INSULAR CORTEX

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“Sense of agency” is a subjective sense of responsibility for an action and its outcome. Several previous studies showed that the sense of agency affects the stimulus-preceding negativity (SPN), which is thought to be generated in part by the anterior insular (AI) cortex. Although the emergence of the sense of agency appears to be closely linked to the AI, its neural correlates are still unclear. In the current study, we clarified the relationship between the sense of agency and the insular cortex by conducting two independent experiments, one with event-related potential (ERP) and one with functional magnetic resonance imaging (fMRI). In both experiments, we used the same gambling task where participants (27 for the ERP experiment and 26 for the 1.5 T fMRI experiment) were required to make a choice between two alternatives. There were different participants in the two experiments. The ERP experiment showed that the sense of agency increased the SPN amplitudes over the right prefrontal regions, suggesting the involvement of AI. Consistent with this result, the fMRI experiment revealed enhanced activities of the right anterior insular cortex due to the sense of agency. Although parallel observations in the two experiments cannot warrant causal inference, our findings support the assumption that anterior insular cortex may contribute to the effect of agency on the SPN.

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Parasympathetic activity, as indexed by respiratory sinus arrhythmia (RSA), has been associated with social engagement in individuals. But whenever people interact their biological systems become interdependent, creating an interpersonal dynamic system that goes beyond the individuals. One feature of dynamic systems is that they have states that they are drawn to, called attractors, and in close relationships such attractors may act as both precursors and outcomes of socio-emotional processes. In this study we investigate the tendency of partners to be pulled into a dyadic state characterized by shared RSA levels, which would suggest a shared parasympathetic attractor. We use data from 64 committed heterosexual couples engaged in mixed emotion conversations to test the hypothesis that trying to empathize with a partner and feelings of connection would be associated with the formation of a shared parasympathetic attractor. Both partner’s RSA was measured in 4 sec. units across the conversation, including duration in shared RSA states, number of entries into that state, and how quickly they first entered that state. As expected, all indicators of a shared parasympathetic attractor both predicted, and were predicted by, higher male reports of trying to empathize with their partner. Similarly, the same indicators of attractor formation were bidirectionally associated with higher connection for both partners, suggesting that RSA dynamics at the dyadic level may both promote and arise from intimacy.

FOR BETTER AND WORSE? THE ROLES OF CLOSENESS, MARITAL BEHAVIOR, AND AGE IN SPOUSES’ CARDIOMETABOLIC SIMILARITY

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Spouses share common risks for cardiometabolic diseases: a person’s diabetes or hypertension raises the partner’s odds of developing the same condition. The mechanisms responsible for this disease concordance remain poorly understood. To examine three factors that may modulate partners’ cardiometabolic similarity—closeness, hostile marital behavior, and age—and whether health behavior concordance plays a role, 43 healthy couples ages 24–61 provided fasting glucose, metabolic data (fat and carbohydrate oxidation), and resting blood pressure before discussing one of their most severe marital disagreements, on two separate occasions. Accounting for the effects of sex, age, study visit, and abdominal fat on cardiometabolic levels, we found that aspects of health behavior concordance were associated with greater similarity in glucose, diastolic blood pressure (DBP), and carbohydrate and fat metabolism. Independent of health behavior concordance, partners who felt closer and behaved in a less hostile way had more similar rates of fat oxidation; less hostile partners also shared greater overlap in carbohydrate oxidation. Likewise, fasting glucose and DBP were more similar within older couples compared to younger pairs, beyond effects of health behavior concordance. In sum, closer, less hostile, and older couples shared more similar fasting glucose, metabolic data, and blood pressure. Health behavior concordance was unrelated to these predictors and did not explain their associations, suggesting that multiple paths may lead to shared disease risks.

AUTISM SPECTRUM DISORDER (ASD) is characterized by impairments in social communication, but its neurobiological underpinnings are not often studied during face-to-face exchanges. Relatedly, how the social partner affects ASD symptoms is not fully understood. Here, we collected electroencephalography (EEG ‘hyperscanning’) and eye gaze data from parent-child and clinician-child pairs during naturalistic social interactions. Inter-brain coupling between children and adults varied as a function of the social partner (higher if the partner was a caregiver), context (higher if there was no toy present), and direct gaze (higher for interactions with more social gaze): children exhibited the most eye contact and the highest inter-brain coupling with a caregiver, and when there was no non-human object in the room. Taken together, the results suggest that dual neurophysiological recordings and gaze-tracking during naturalistic social exchanges can complement controlled laboratory methods in providing insight into the brain basis of real-time child-adult interactions, with the potential to increase our understanding of social communication abnormalities in autism.

This symposium brings together four emerging leaders in developmental science who all seamlessly integrate biological processes to understand development. The goals of the symposium are 2-fold. First, we will demonstrate the value-added in understanding psychophysiological markers from a developmental perspective by highlighting how biological processes unfold across development and alter the development of cognitive, social, and emotional behaviors. Second, we do so by challenging the perception created by the extant literature that these biological markers are static mechanisms that operate the same regardless of age and environmental context. To do so, we frame this symposium by borrowing a developmental science conceptual framework forth put forth by Pérez-Edgar & Hastings in 2018—one that highlights our science as being shaped by both experimental and naturalistic/individual-difference designs and that embracing and integrating both approaches is key to advancing science. These two designs have historically been distinct with one focusing on the mechanisms (embracing the question of “can”) in the examination of the role of a process in the explanation of development, as Pérez-Edgar & Hastings point out) while the other focuses on observations (“do” certain processes influence development). However, both can inform description of developmental processes—one with tightly controlled experiments that speak to causality and the other with richly characterize longitudinal observations that capture the complexity of development as it unfolds (within and between individuals). Both of these approaches are highlighted in the current symposium.
Humans are social beings. Our bodies and brains have evolved to connect with one another. We need social interaction to survive during early life, and to stay physically and psychologically healthy across the life span. A comprehensive psychology framework that neatly captures the intrinsic human need for social connection, particularly when in need, is attachment theory. Recently, however, attachment theory has been vividly discussed and some of its core assumptions challenged, with claims reflecting both an under- as well as over-estimation of the role of attachment in our lives. In my presentation, I will talk about research from the Social Neuroscience of Human Attachment (SoNeAt) Lab that combines state-of-the art neuroimaging methods to measure brain structure and function with assessment tools derived from attachment theory. I will first show fMRI data obtained in individual participants, which—in combination with results from other labs—provided the basis for the formulation of two functional-neuro anatomical models of organized and disorganized human attachment (NAMA and NAMDA). I will then show fNIRS hyperscanning data obtained in parent-child dyads that allows for assessing interpersonal neural as well as bio-behavioral synchrony within attachment and caregiving settings. I will close by integrating the illustrated data and theoretical considerations with other psychology and evolutionary theories of human social interaction to reflect upon a possible unifying model of the neurobiological basis of human sociality. It is my hope that the described work will advance attachment theory within the 21st century and provide future avenues for the development of prevention and intervention strategies linked to attachment and caregiving difficulties across the life span.

PSYCHOPHYSIOLOGICAL TOOLS FOR UNDERSTANDING DEVELOPMENTAL CHANGE IN CHILDREN AND ADULTS

Rebecca J. Brooker
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Psychophysiological approaches offer unique opportunities for understanding how one's experiences “get under the skin” to influence long-term change. Such work typically focuses on very young children, for whom physiological systems are viewed as most plastic. Yet, change is limited neither to childhood nor to single generations. In this talk, I will present results from three projects in my laboratory that focus on psychophysiological mechanisms of development during infancy, early childhood, and adulthood. First, I will discuss work targeting the Late Positive Potential (LPP) or Late Positive Potential, which is thought to reflect neural processing of emotional or self-relevant events. Second, I will show that consideration of state versus trait levels of psychophysiological assessment, illustrated in a sample of pregnant mothers, can be informative for investigations of anxiety, but require careful consideration of the construct of interest, particularly whether one prioritizes independent or overlapping symptoms of disorder. Finally, I will provide an explicit illustration, using a novel within-person measure of delta-beta coupling, of the value added by taking a developmental approach such that trajectories offer more information about emotional development between ages 3 and 7 than do point estimates. Findings convey added benefit of developmental perspectives for understanding links between psychophysiology and emotion.

PSYCHOPHYSIOLOGICAL EMOTION REGULATION AND DIGITAL TECHNOLOGY USE IN ANXIOUS ADOLESCENTS

Sarah Myruski1, Jennifer DeRutte2,3, Amy K. Roy4,5, and Tracy A. Dennis-Tiwary1,2
1The Pennsylvania State University, 2Hunter College, CUNY, 3The Graduate Center, CUNY, 4Fordham University, 5NYU Langone School of Medicine

Adolescence is a period of peak anxiety onset, and rapid social, emotional, and neural development. The social-emotional lives of adolescents are largely conducted via digital technologies (DT) like social media (PEW, 2018), highlighting the need to consider online social interactions in pursuit of developmentally-appropriate and ecologically-valid investigations of anxiety in youth. The past decade of research on DT and anxiety, predominately focused on subjective measures in adults, has yielded mixed results (e.g., Keles et al., 2020 review). A key step forward is to leverage psychophysiology to identify individual differences in cognitive and emotional functioning that may confer vulnerability to the negative effects of DT use. To this end, this study examined difficulties with emotion regulation (ER), indexed via EEG, ERP, and eye-tracking, as moderators of the link between DT use and anxiety in adolescents ($N = 76$; 42 female) aged 12–14 years ($M = 13.28$, $SD = 0.87$). Resting state delta-beta coupling (DBC), reflecting functional coherence between cortical-subcortical neural circuitry underlying ER, was generated during an 8-minute baseline task. Attention bias (AB), an implicit form of ER (e.g., Todd et al., 2017) defined as selective and exaggerated attention toward threat, was indexed using eye-tracking (percent fixation) during free viewing of emotional and neutral faces and using ERPs during a dot probe task. ERPs quantified exaggerated attentional selection and discrimination (N170) and impeded cognitive control (N2) to threat versus neutral faces. Psychophysiological ER moderated associations between DT use and anxiety, while parent-reported ER and reaction-time-based AB did not. Preferences to use DT versus face-to-face interactions for emotion communication predicted elevated anxiety, specifically among teens showing blunted N2 and enhanced N170 to threat faces. Greater time per day spent using DT similarly predicted greater panic symptom severity, specifically for those showing high levels of attentional capture by threat via eye-tracking. Similarly, among teens showing low DBC, use of more digital platforms predicted greater generalized anxiety. These patterns suggest that anxious youth with poor ER may turn to low-barrier, controllable, technology-mediated social interactions to express and manage emotions. Future research will clarify long-term implications, such as whether habitual DT use serves to maintain or exacerbate anxiety symptoms by replacing opportunities face-to-face interactions.
STATE AFFECT INFLUENCES IN EVENT-RELATED POTENTIAL RESEARCH: CONSIDERATIONS FOR UNDERSTANDING INTERNALIZING AND EXTERNALIZING PSYCHOPATHOLOGY

Session Chair: Brian Albanese
Auburn University
Discussant: Anna Weinberg
McGill University

Descriptors: Affect, Psychopathology, ERP

Research utilizing event-related potentials (ERPs) has largely focused on how these components are derived and relate to self-reported average psychopathology symptoms, irrespective of current mood (i.e., trait-level effects). However, there is growing evidence that some ERPs are sensitive to emotional inductions, suggesting that state affect could be important to understanding ERPs and how they relate to psychopathology. Building upon this literature, the current symposium will feature four talks focused on better understanding the impact of state affect on ERPs in internalizing and externalizing psychopathology. Presenter 1 will discuss how the P3 during a modified flanker task is impacted by the presence of potential threat, and how this helps us better understand posttraumatic stress disorder (PTSD). Presenter 2 will use growth curve modeling of the LPP across a task to evaluate how emotional responses to one image influence reactivity to subsequent emotional stimuli, and the role that this plays in self-reported emotion regulation. Presenter 3 will utilize the late positive potential (LPP) and an acute stressor to show how cannabis cue reactivity under acute stress confers vulnerability for cannabis use disorder. Presenter 4 will demonstrate the influence of both affective context and threat cross-sectionally associated with greater PTSD symptoms. In Study 1, cannabis users high in DI viewed cannabis and matched neutral vis-

Background: Disruptions in cognitive control, particularly under stress, is theorized to be a key etiological and maintenance factor for posttraumatic stress disorder (PTSD). However, little research has tested whether stress-elicited cognitive dyscontrol is associated with PTSD either cross-sectionally or prospectively. Method: Electrodermal data were collected while trauma-exposed participants (Study 1: N = 87; Study 2: N = 64) completed a modified Flankers task with two counterbalanced conditions: Stress (mistakes were punished) and neutral (no punishment). Temporospatial Principal Component Analysis (PCA) was used to extract the P3 on stress and neutral trials, and then the Δstress P3 was computed by regressing the stress P3 onto the neutral PSW. Study 2 participants also completed six surveys across two weeks assessing daily stress and daily PTSD symptoms. Results: Results from both Study 1 (β = −.33, p = .012) and Study 2 (β = −.48, p = .004) indicated that a blunted Δstress P3 was cross-sectionally associated with greater PTSD symptoms. In Study 2, a blunted Δstress P3 prospectively predicted greater PTSD symptoms across two weeks (B = −2.94, SE = 1.02, p = .066) and amplified the effects of within-subject increases in daily trauma reminders on daily PTSD symptoms (B = −0.36, SE = 0.13, p = .066). Discussion: These data suggest, across two studies, that a worse ability to engage cognitive control under stress is associated with greater PTSD symptoms, perhaps by amplifying the effects of daily stress on same-day PTSD symptoms.

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DIFFICULTIES IN REGULATING EMOTION: THE EFFECT ON INTRAINDIVIDUAL CHANGE IN THE LATE POSITIVE POTENTIAL

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Emotion regulation (ER) difficulties are a transdiagnostic risk for psychopathology. The late positive potential (LPP) in response to affectively salient images is impacted by ER difficulties. Studies examining the impact of ER difficulties on the LPP have focused on the mean amplitude of the LPP, neglecting the time-course of the LPP. The current study examined whether ER difficulties, measured by the lower-order Difficulties in Emotion Regulation (DERS) scales (i.e., strategies, non-acceptance, impulse, goals, awareness, and clarity), predicted LPP change from 500 to 3,000 ms (time was captured as five 500ms mean amplitudes) as well as the autoregressive effect when people view unpleasant and pleasant images. The sample comprised 251 community participants (M_age = 35.5, SD = 16.0; 44% male; 91% meeting for DSM-5 diagnosis) enrolled in an intervention to reduce suicidal ideation risk factors. Using multilevel modeling, LPPs were modeled including random slopes and AR1 parameters predicted by DERS scales. For the unpleasant images LPP, there was a significant autoregressive effect (B = .68, p < .001). Further, this lagged effect was modulated by the DERS impulsivity (B = −.01, p = .04) and awareness (B = −.01, p = .03) scales. For the pleasant images LPP, there was also a significant autoregressive effect (B = .68, p < .001); however, there were no significant effects of DERS scales on this effect. Across both image types, the slope parameter was nonsignificant. These findings suggest that the time-course of the LPP can be influenced by an individual’s trait ER difficulties.

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ACUTE STRESS MODULATION OF THE CANNABIS CUE-ELICITED LATE POSITIVE POTENTIAL: TOWARDS A NOVEL BIOMARKER OF CANNABIS USE DISORDER SEVERITY AND CHRONICITY

Richard Macatee, Kaveh Afshar, and Meghan Carr
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The prevalence of regular cannabis use and cannabis use disorder (CUD) has increased in the United States over the past two decades, but the majority of regular users do not develop CUD. Elevated self-reported distress intolerance (DI) is associated with CUD risk, but little is known about the underlying neural mechanisms. In study 1, cannabis users high (n = 61) and low (n = 44) in DI viewed cannabis and matched neutral visual stimuli before and after a lab stressor during electroencephalography (EEG) recording. Acute stress-elicited motivated attentional processing of cannabis-related cues (i.e., the late positive potential [LPP], a positive slow wave evoked by motivationally-salient stimuli) was enhanced in the high vs. low DI group, pr^2 = .018, p = .021, and post-stressor cannabis cue-elicited LPP amplitude was positively associated with CUD severity, pr^2 = .08, p = .012, worse treatment outcome, pr^2 = .05, p = .035 state stress-relief cannabis craving, r = .29, p = .033, and behavioral performance during the lab stressor, r = .29, p = .032. A separate sample (study 2) is currently being recruited (n = 85) to (1) replicate study 1 findings, (2) evaluate test-retest reliability of acute stress modulation of the LPP to cannabis cues, and (2) test relations between autonomic/endocrine measures of stress responding and LPP modulation by cannabis cues. Acute stress modulation of the cannabis cue-elicited LPP may be a valuable biomarker of CUD risk in regular cannabis users; theoretical and clinical implications will be discussed.
AFFECTIVE CONTEXT, PRIOR EXPERIENCE AND AGENCY: EFFECTS ON COGNITIVE REAPPRAISAL AND ERROR MONITORING
Annmarie MacNamara, Michael Imburgio, and Elizabeth Bauer
Texas A&M University

State manipulations of anxiety may not operate in isolation to affect brain and behavior, but may interact with other factors, such as prior experience and agency. We tested this idea using two different paradigms. In the first study, participants (n = 47) performed a reappraisal task while being exposed in a blockwise fashion to an unpredictable, anxiety-provoking auditory tone or silence. Reappraisal was shown to be most effective in reducing the late positive potential when performed in a predictable/calm context by participants whose initial learning context was also predictable/calm, F1(1, 45) = 16.65, p < .001. Therefore, the combined influence of current affective context and prior experience determined reappraisal’s success. In a second study (n = 90), we examined how punishment and a between-group manipulation of agency affected error monitoring. Results showed that lack of agency (i.e., being yoked to another participant who was punished for their errors) reduced the error-related negativity, even in ‘safe’ blocks, t(88) = 2.46, p = .02. On the other hand, agentic participants (i.e., not yoked) showed fewer errors overall, and only these participants showed reduced error rate during punishment versus safe blocks, t(46) = 5.24, p < .001. Therefore, manipulations of agency affect error monitoring and punishment interacts with agency to affect error commission. Results suggest that learned experience may interact with affective context to affect emotion regulation and error monitoring.

BEYOND GRAND AVERAGING: USING SINGLE-TRIALS ERPS TO STUDY WITHIN-PERSON VARIATION IN NEUROCOGNITIVE PROCESSES

Session Chairs: Hannah Volpert-Esmond and Bruce Bartholow
1University of Texas, El Paso, 2University of Missouri, Columbia
Discussant: Elizabeth Page-Gould
University of Toronto

Descriptors: ERPs, Multilevel Modeling, Single-trial

Increasing the notoriously low signal-to-noise ratio in psychophysiological assessment typically involves averaging measurements over repeated trials, which assumes that relevant cognitive processes are stable across trials and any within-individual variability in the physiological response stems from psychologically irrelevant sources (i.e., noise). This symposium challenges this assumption by showcasing work examining meaningful variation in EEG/ERPs across trials. Volpert-Esmond will provide an overview of how multilevel models are used to parse signal from noise at the trial level, with an example showing how within-person, trial-to-trial variability in the P2 ERP elicited by faces predicts the speed of overt race and gender categorization. Both Clayson and Tobias will use a similar approach to examine clinically relevant individual differences (psychosis, anxiety, depression) in the late positive potential elicited by socially-relevant emotional images as a function of person-specific image ratings and the rate of habituation to negative feedback over trials, respectively. Finally, Cavanagh will discuss the relationship between single-trial EEG measures (ERPs and mid-frontal theta) and behavior-derived prediction errors in both humans and mice, extending the utility of the trial-level approach to translational psychophysiology. These examples demonstrate the benefit of examining single-trial EEG responses for understanding within-subject variation in neurocognitive processes, clinically relevant individual differences, and the relationship between brain and behavior.

RACE AND GENDER CATEGORIZATION OF FACES: THE BENEFIT OF EXAMINING WITHIN-PERSON VARIATION

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Person construal—the process of placing people we encounter into meaningful social categories such as race, gender, and age—is a fundamental component of human cognition and occurs within mere hundreds of milliseconds of seeing a face. Prominent models of person construal (Freeman & Ambady, 2011) posit an iterative process through which sensory information is accumulated and integrated with top-down factors before a stable (race, gender, etc.) category representation is reached. However, little research has parsed apart the unique contributors to person construal and how these cognitive processes may vary from trial to trial. Across three studies (total N = 196), two categorization tasks (categorizing faces by race and gender), and participants of different races (White and Black participants), we examined within-person relationships between early attention to faces (indexed by P2 amplitude), stimulus evaluation (indexed by P3 latency), and reaction time (RT) for categorization responses. Within-person trial to trial variation in P2 amplitude negatively predicted RT, such that enhanced attention to a face on a particular trial facilitated faster categorization responses. Additionally, this relationship was partially mediated by P3 latency, such that more early attention facilitated faster stimulus evaluation and consequently a faster response. Thus, taking a single-trial approach allowed us to identify within-person relationships between cognitive processes underlying race and gender construal of faces and response behavior that are not evident using an averaging approach.

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A TRIAL-LEVEL ANALYSIS OF ANXIETY, DEPRESSION, AND NEGATIVE PERFORMANCE-RELATED ERPS

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Anxiety is associated with persistent sensitivity to negative information derived from internal and external sources. This sensitivity is apparent both in clinical symptoms (e.g., worry, hypervigilance) and in event-related potentials (ERPs) associated with receiving negative feedback and committing errors (i.e., the feedback related negativity (FRN) and error related negativity (ERN)). We conducted trial-level analyses using a large existing dataset (n = 273) to examine whether anxiety is associated with sustained sensitivity to negative performance markers over time. Similar hypotheses regarding depression were also tested, given that depression is also associated with a negativity bias. Anxiety was associated with better-sustained FRN/ERN over time in task, FRN: b = −0.42, t(227200) = −6.61, p < .001; ERN: b = −0.27, t(79990) = −5.73, p < .001. Depression was associated with better-sustained FRN over time for both negative, b = −0.44, t(227200) = −6.24, p < .001, and positive feedback, FRN: b = −0.17, t(256700) = −2.82, p < .005, but less-sustained ERN during the second half of the task, b = 0.28, t(82210) = 2.15, p = .03. These results suggest variation over time as a neglected dimension by which FRN/ERN serve as risk markers of anxiety and depression.

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AN EXAMINATION OF SINGLE-TRIAL LATE POSITIVE POTENTIALS TO SOCIALLY-RELEVANT IMAGES IN PROBANDS WITH PSYCHOSIS, THEIR SIBLINGS, AND CONTROLS: A MULTILEVEL MODELING APPROACH

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A prominent motivational theory of emotion suggests that appetitive and defensive systems enhance attention to affective stimuli. A few ERP studies suggest these motivational systems are broadly intact in people with psychosis. It remains unclear whether those with, or at heightened risk for, psychosis show abnormal ERP responses to particular types of stimuli, such as socially-relevant emotional images. To address this issue, we examined late positive potential (LPP) amplitudes to images involving people that were normatively pleasant (affiliative images), unpleasant (threatening images), or neutral in 86 probands with psychosis, 26 of their unaffected siblings, and 39 controls. Multilevel models were used to predict single-trial LPP amplitudes from group membership and person-specific arousal and valence ratings of each image. Single-trial LPP measurements were nested within images (each presented twice) nested within participants nested within families. Only the sibling and control groups showed larger LPP to high-arousing images than to low-arousing images. LPP was not significantly related to arousal ratings in the proband group. Slopes for the arousal/LPP relationship were only significantly different between the proband group and control group. The impaired sensitivity to emotion in social images among probands with psychosis suggests disruption in the core motivational system for socially relevant information. These findings provide support for the notion that social deficits may be partially due to an impairment in early emotional responses to social stimuli.

USING REINFORCEMENT PREDICTION ERRORS TO FILTER THE INFORMATION CONTENT FROM SINGLE-TRIAL EEG

James Cavanagh
University of New Mexico

Event-related EEG signals reflect a mix of overlapping latent processes. So how do we correctly infer what cognitive process is contributing to our signal of interest? The most common inferential method relies on experimental manipulation, but this has limited efficacy since a process is defined by what the experimenter did and not by what the subject experienced. An alternative approach involves computational modeling of individual performance, then regressing formal measures of information content on the brain signal. In reinforcement learning models, the trial-specific influence of reward or punishment feedback can be estimated as reinforcement prediction errors (+PEs and –PEs, respectively). I will discuss three novel approaches to using reinforcement PE to infer, remove, or locate the information content of EEG signals. The first example will describe how anxiety significantly correlates with the single trial -PE weighted EEG, identifying a mechanism for heightened internalization of “bad news”. The second example will describe how removing the single trial +PE from the EEG reveals the influence of major depression on the affective content of the residual Reward Positivity. Third, in mice and humans, similar but not identical time-frequency regions-of-interest (mid-frontal delta power) correlate with +PE. In summary, this rather simple approach provides a powerful way to infer mechanisms, parse overlapping information content, and derive common translational markers of preserved process across species.

NEURAL CORRELATES OF ERROR MONITORING AS MARKERS OF RISK, MECHANISMS, AND TRAJECTORIES OF MENTAL DISORDERS

Session Chairs: Anja Riesel¹ and Julia Klawohn²
¹University Hamburg, ²Humboldt-Universität zu Berlin

Discussant: Michael Larson
Brigham Young University

Descriptors: Error-related Negativity, Biomarker, Psychopathology

Multiple forms of psychopathology have been shown to be characterized by aberrant performance monitoring. Specifically, the error-related negativity (ERN) has been identified as a neural biomarker of several internalizing disorders. The current symposium will evaluate new findings on the ERN as a marker of deficits, mechanisms, risk, and change in relation to anxiety, OCD, and depression. Anna Weinberg et al. will examine the effects of life stress on the ERN, and the circumstances in which a heightened ERN might result in increased anxiety. Julia Klawohn et al. will present results linking the ERN to a polygenic risk score for OCD and will examine the ERN as a mediatior disorder-related psychopathology and a moderator of treatment response in OCD. CJ Brush et al. will evaluate whether deficits in performance monitoring in depression can be targeted through short- and long-term interventions, and further evaluate the ERN in comparison to reward-processing ERPs as predictors of intervention-related symptom changes. Finally, Anja Riesel et al. will present data suggesting that the ERN predicts perceived risk and stress during the COVID-19 pandemic, and indirectly affects psychopathological symptoms. Collectively, this symposium further highlights the critical role of error processing for mental health and illustrates the potential of the ERN for improving our understanding of pathomechanisms in psychopathology.

ERROR-RELATED NEGATIVITY AND POLYGENETIC RISK FOR OCD

Julia Klawohn¹, Anja Riesel², and Norbert Kathmann¹
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Heightened error-related negativity is robustly found in individuals with obsessive-compulsive disorder and is discussed as an endophenotypic risk marker for the disorder. Despite known heritability of the ERN and previous findings of increases in first-degree relatives, a direct link to the genetic risk for the disorder was missing to date. In this talk, I will present an association of the ERN amplitude with a polygenic risk score for OCD, both across groups of healthy participants (n = 112), participants with OCD (n = 102), and their first-degree relatives (n = 39), as well as within the OCD group only. Further, initial findings on the role of the ERN as a mediator of psychopathology and a moderator of treatment success in OCD will be presented and discussed. The data presented in this talk provide novel support for the notion of the ERN as a mediating endophenotype for OCD and show that increases in ERN might not only be a risk indicator but rather a mechanism in the course of pathogenesis of OCD.

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FROM RISK TO ILLNESS: MAPPING PATHWAYS TO ANXIETY BY EXAMINING ASSOCIATIONS BETWEEN LIFE STRESS AND THE ERROR-RELATED NEGATIVITY

Anna Weinberg, Iulia Banica, and Aislinn Sandre
McGill University

The error-related negativity (ERN) has been proposed as a vulnerability marker for anxiety, and has been shown to be heritable, with alterations in ERN magnitude evident in unaffected first-degree relatives of individuals with anxiety. However, it is not only family factors that influence the ERN—moreover, as evidenced by studies of first-degree relatives, not everyone with an enhanced ERN will exhibit heightened anxiety. In this talk, I will explore both the effects of life stress on the ERN, and the circumstances in which a heightened ERN might result in increased anxiety. In study one, I will discuss how the type and timing of stressors matter for understanding the association between life stress and the ERN. In study two, I will discuss evidence from an emerging adult sample indicating that a heightened ERN interacts with stressors to predict increased anxiety six months later, suggesting this larger ERN might make individuals more vulnerable to the adverse effects of stress. And finally, I will discuss ecological momentary assessment (EMA) data from emerging adults, demonstrating that the magnitude of the ERN predicts changes in negative affect in response to daily stressors. Combined, the results of these studies suggest that environmental and learning experiences can influence the magnitude of the ERN over the long term, and that these alterations in the ERN may subsequently render individuals more reactive to stressors, pointing to a potential pathway through which the ERN may increase risk of anxiety disorders.

THE PREDICTIVE VALIDITY OF THE ERROR-RELATED NEGATIVITY FOR COVID-19 RELATED RISK, STRESS, AND SYMPTOMS

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1University Hamburg, 2Humboldt-Universität zu Berlin

The error-related negativity (ERN) is a well-validated neural response to errors that has been studied in multiple forms of psychopathology. Heightened ERN amplitudes are assumed to represent a neural risk marker for obsessive-compulsive disorder and several anxiety disorders and have been shown to precede symptom development. During this talk, I will present data examining the predictive validity of the ERN as a neural vulnerability marker for COVID-19-related risk, stress, and symptoms. Between February and May 2020, 113 subjects from previous EEG studies (2014–2019) took part in an online survey and a clinical telephone interview. Results indicate an association between the ERN measured before the pandemic and an increased perceived risk for an COVID-19 infection and severe illness course. This perceived risk mediated an association between the ERN and increased stress experience during the first COVID-19 wave. Increased stress in turn was associated with a range of psychopathological symptom dimensions including anxiety, depression, and obsessive-compulsive symptoms. In summary, there was an indirect effect of the ERN recorded before the pandemic on psychopathological symptoms during the first COVID-19 wave mediated through its effects on perceived risk and stress. Together, these results further strengthen the assumed role of ERN as a transdiagnostic neural risk marker for psychopathology and highlight the important role of stress in this relation.

Funding: German Research Foundation, grants: KA8159/1, R1-2853/2-1

NEURAL INDICATORS OF PERFORMANCE MONITORING IN DEPRESSION: THE ERROR-RELATED NEGATIVITY AND REWARD POSITIVITY AS TARGETS AND PREDICTORS OF RESPONSE TO AEROBIC EXERCISE

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Major depression is a heterogeneous disorder associated with poor treatment outcomes. Due to high symptom variability, matching individuals with the most effective treatments has remained a major challenge. It is critical to elucidate whether core features of depression can be leveraged to distinguish what works best and for whom. The present talk aims to address this challenge by examining neural processes linked to error monitoring (i.e., error-related negativity [ERN]) and reward processing (i.e., reward positivity [RewP]) in response to acute (i.e., single bouts) and longer-term aerobic exercise interventions for depression. The first part of this talk will focus on data from two separate studies that examined the impact of a single bout of exercise on ERN and RewP. In study one, ERN was examined in adults with major depression. In study two, RewP was assessed in adults with high and low depressive symptom severity. In the second half of this talk, we examined the effects of a longer-term exercise intervention on ERN and RewP in adults with major depression and show that exercise reduces depressive symptoms, especially among those with a lower pretreatment RewP. Pretreatment ERN did not predict response to exercise and in both interventions, exercise did not modify ERN or RewP. Collectively, these findings extend literature on the ERN and RewP in depression to indicate that these neural indicators may not be normalized by exercise but may have utility as predictors of response to interventions.

Symposium 7.1

THE BRAIN IN CONTROL: INVESTIGATION OF INDIVIDUAL DIFFERENCES IN COGNITIVE CONTROL

Session Chairs: Gabriele Gratton and Monica Fabiani
University of Illinois, Urbana-Champaign

Descriptors: Cognitive Control, Aging, Prefrontal Cortex

Individuals differ in their ability to flexibly adapt the way they process information to changing contextual demands. This flexibility is critical for meeting the challenges we experience in everyday life, from driving a car, to multitasking, to correctly interpreting the information we receive, to the ability of suppressing responses or motion plans that are no longer appropriate. Older individuals, or individuals with psychopathological conditions or lesions in the frontal cortex, may find adapting to changing processing demands particularly challenging. Theoretical and methodological innovations obtained in the last couple of decades have greatly expanded our understanding of how the brain exert such cognitive control function and how aging and psychopathology may influence these brain processes. This symposium presents novel data from several laboratories using different methodologies (lesion studies, fMRI, ERPs, and EEG) to investigate how theoretical constructs (such as the distinction between proactive and reactive control, models of cognitive control, or inhibitory processes) and way they may be implemented in the brain can predict relationships between individual differences in brain phenomena (such as lesion in frontal cortex, activation patterns of the frontal-parietal network, amplitude of different ERP components, and propensity to show high or low alpha and theta power) and behavioral responses in normal young and elderly individuals, psychopathological and neurological conditions.

Funding: NIA
Extensive research indicates that theta (4–8 Hz) bursts are involved in re-programming the information processing system after stimuli delivering conflicting or otherwise unpredictable information. Hence, it has been proposed that theta plays a special role in cognitive control. However, other frequency bands, including alpha (8–12 Hz), also show changes (typically suppression) under these conditions. Further, alpha is enhanced in tasks that require participants to maintain stimulus/task representations over time (e.g., working memory tasks). Finally, alpha power before the presentation of weak stimuli is associated with reduced processing.

Gratton (2018) proposed that alpha and theta exert complementary roles in cognitive control, with alpha facilitating the maintenance of existing representations (both stimulus and task related) and theta facilitating representation updates. As such, we hypothesized that theta may be more directly associated with reactive control, and alpha with proactive control (see Braver, 2012). A recent study involving younger and older adults (Clements et al., 2020) revealed an association between resting alpha activity and proactive control, and resting theta activity and reactive control, thus supporting this proposal. This study also showed that resting-state alpha, but not theta, was reduced in aging, a finding consistent with the idea that proactive control processes, our ability to develop explanatory models that integrate across multiple levels of analysis is often hampered by weak integrative approaches. McKewen et al (2019) found that a self-report measure of cognitive control mediated the relationship between impulsivity and real-world outcomes, but behavioural and ERP measures of proactive control did not, questioning their sensitivity. Here we use a model-based neuroscience approach to develop latent measures of proactive control that are simultaneously informed by behavioral and EEG data from a task-switching paradigm. We compared three bivariate joint models using a covariance hierarchical Bayes approach to link a neural model (EEG epochs) and a behavioral model (diffusion decision model, DDM). Model 1 linked EEG with response criterion, Model 2 added a preparation to switch parameter, and Model 3 added a task rule uploading parameter. For each model, beta values were extracted denoting the linking strength between the EEG and the each parameter. Hyper-parameter estimates were used to reconstitute behavioral and ERP data. Model 3 showed greater fidelity to the original data, with criterion setting linked to immediate pre-target activity (900–1,000 ms), and switch preparation task preparation coinciding with the switch-positivity (300–500 ms) and pre-target negativity onset (600–700 ms). These findings support distinct proactive control processes and show the plausibility of deriving neurally-informed decision models of task-switching.

**Funding:** ARC.

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**NOT ONLY THETA: COMPLEMENTARY ROLES OF THETA AND ALPHA OSCILLATIONS IN COGNITIVE CONTROL**

Gabriele Gratton, Grace Clements, Daniel Bowie, Kathy Low, and Monica Fabiani
University of Illinois, Urbana-Champaign

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**INHIBITORY CONTROL DEFICITS IN HEALTHY AGING AND LESION PATIENTS AS IDENTIFIED BY BAYESIAN MODELING AND BETA-BURSTS**

Jan Wessel, Yoojong Choo, Dora Matzke, Mark Bowren, and Daniel Tranel
University of Iowa

Over the last three decades, cognitive psychology and neuroscience have made great strides to understand the processes underlying the inhibitory control of action. Basic work using the stop-signal task can help clinicians understand inhibition-related symptoms in neuropsychiatric patient populations. Two recent discoveries hold great promise in this regard: (1) Bayesian computational models of stop-signal behavior can parse whether behavioral impairments are due to genuine inhibitory deficits or due to attentional deficits that impair the triggering of the stopping process (Matzke et al., 2013). (2) Scalp-recorded beta-bursts can reveal the trial-torial electrophysiological dynamics of stop-signal behavior (Wessel, 2020). Here, I will present data from an EEG and modeling investigation of stop-signal behavior in healthy younger and older adults, as well as in patients with right inferior frontal cortex (rIFC) lesions, who are known to show impaired stop-signal behavior (Aron et al., 2003). We found that while healthy older adults can compensate for impaired stopping abilities by implementing proactive control, rIFC lesion patients show a clear stopping deficit, likely due to an impairment in triggering the stopping process. In line with this, rIFC lesion patients show decreased rates of beta-bursting over fronto-central scalp areas, a known signature of the stopping process. Taken together, these findings shine new light onto the specific clinical deficits that show by brain lesion patients and demonstrate a new approach to the clinical neuroscience of inhibitory control.

**Funding:** NIH, NSF.
Turning Threat Into Safety: A Variety of Emotional Manipulations and Their Underlying Neuronal Mechanisms

Session Chairs: Barbara Schmidt¹ and Matthias Sperl²
¹University of Jena, ²University of Marburg

Descriptors: Emotion, Threat, Anxiety

In our symposium, we explore manifold ways to turn threat into safety. Here, we show how to (a) investigate noradrenergic effects on fear conditioning and fear extinction, (b) enhance the perceived control over potentially threatening stimuli, (c) suggest participants that they are in a safe place during hypnosis, or (d) directly intervene in neuronal circuits of the frontal brain that control approach and avoidance behavior. Matthias Sperl (University of Marburg, Germany) demonstrates that the noradrenergic substance yohimbine enhances fear recall in a fear conditioning study. Elizabeth Bauer (Texas A&M University, USA) shows that the experience of control over stimuli modulates how we perceive stimuli, revealed by electrophysiological responses. Barbara Schmidt (University of Jena, Germany) presents emotional, neuronal and behavioral responses to the hypnotic suggestion to feel safe in the laboratory and in the intensive care unit. Regina Lapate (UC Santa Barbara, USA) demonstrates that using TMS (continuous theta burst) to target multivariate goal representations in LPPFC reduces avoidance responses to negatively valenced stimuli. Our symposium links researchers from four international laboratories, applying a broad variety of research methods like pharmacology, EKG, EEG, hypnosis, fMRI, and TMS. We explore new ways of turning threat into safety and elucidate their underlying neuronal mechanisms, opening new avenues for psychophysiological research.

Pharmacological Modulation of Threat and Safety: Noradrenaline Potentiates Conditioned Fear Bradycardia and N170/LPP ERP Amplitudes

Matthias Sperl¹,²,³, Christian Panitz¹, Nadine Skoluda¹, Urs Nater⁴, Diego Pizzagalli, Christiane Hermann, and Erik Müller¹
¹University of Marburg, ²University of Giessen, ³Harvard Medical School, ⁴University of Vienna

Fear conditioning is an important model for understanding the etiology and maintenance of anxiety disorders, while extinction of fear is considered to reflect the underlying learning process of exposure therapies. Hyperconsolidation of aversive associations and poor extinction have been hypothesized to be crucially involved in the acquisition of pathological fear. Previous animal and human research has pointed to a potential role of the catecholaminergic system, particularly noradrenaline and dopamine, in acquiring emotional memories. Here, we investigated whether the noradrenergic alpha-2 adrenoceptor antagonist yohimbine and the dopaminergic D2 receptor antagonist sulpiride modulate human long-term fear conditioning and extinction. Fifty-four participants received yohimbine (10 mg, n = 18), sulpiride (200 mg, n = 18), or placebo (n = 18) between fear acquisition and extinction. The yohimbine group showed increased alpha-amylase activity, confirming a successful manipulation of central noradrenergic release. We assessed recall of conditioned (non-extinguished CS+ vs. CS−) and extinguished fear (extinguished CS+ vs. CS−) 24 hours later. Importantly, potentiated fear bradycardia and larger amplitudes of the N170 and LPP ERP components indicated that yohimbine treatment (compared to placebo and sulpiride) enhanced fear recall during day 2. In conclusion, these results suggest that yohimbine potentiated cardiac and central electrophysiological signatures of fear memory consolidation. Our findings elucidate the key role of noradrenaline in strengthening conditioned fear.

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Threat Controllability, Picture Processing and Error Salience

Elizabeth Bauer¹, Gina Thomas², and Annmarie MacNamara³
¹Texas A&M University, ³University of Georgia

The controllable nature of threatening stimuli may moderate their psychological impact. We present results from two novel paradigms that modulated current and/or prior experiences of control over threatening stimuli. In one of these paradigms, participants (n = 48) were told that they could press a button to make threatening and neutral pictures disappear off the screen; however, unbeknownst to participants, this was only true in some blocks of the task (control blocks) but not in others (no control blocks). Results showed that prior experiences of control (i.e., having started the task in a control versus no control block) interacted with current experience of control to affect the late positive potential elicited by threatening pictures (p = .04). In another paradigm, participants in one group (not yoked, n = 47) were shocked following errors in some blocks of a flanker task (punishment blocks) but not in others (control blocks). Participants assigned to another group (yoked, n = 43), were yoked to participants in the not yoked group and received shocks at random times during punishment blocks, and no shocks during control blocks. Results showed that yoked participants had smaller error-related negativities (ERN) compared to not yoked participants (p = .01). Though yoked participants also had higher error rates, this did not explain results for the ERN. Additionally, only not yoked participants showed fewer errors in punishment versus control blocks (p = .02). Results suggest that both current and prior control affect resource allocation to subsequent, threatening events.

Funding: National Institute of Mental Health grant, K23MH105553 (to AM)

Hypnotic Suggestions of Safety in the Lab and in the Intensive Care Unit

Barbara Schmidt
University of Jena

Imagine you are at a safe place with all your senses! In my talk, I show results of three recent studies in which I suggested the feeling of safety during hypnosis and tested its effect on subjective ratings, EEG parameters, heart rate and breathing rate in different experimental settings. The first study was conducted in the EEG laboratory and revealed that feeling safe significantly reduced P300 amplitudes to monetary rewards that participants received during a risk game. Risk behavior was not affected by the suggestion of safety. The results of the second EEG study showed that the reward positivity to immediate and delayed rewards was significantly reduced when participants felt safe, indicating less impulsivity. The third study was with patients in the intensive care unit. We included patients that had to undergo non-invasive ventilation and were afraid of it. We suggested them to be at a safe place during the non-invasive ventilation procedure. Pre-post comparisons revealed that patients felt significantly better, less anxious, and less aroused after the intervention. We also recorded patients’ physiological responses time-locked to the suggestion text and found that breathing rate and heart rate were significantly reduced during the suggestion to feel safe. The three studies show that the suggestion to feel safe is a powerful tool to induce subjective well-being and relaxation. It can reduce impulsive behavior and help patients accept necessary but challenging medical procedures like non-invasive ventilation.

Funding: This research was funded by the Milton Erickson Society for Clinical Hypnosis.
LATERAL PREFRONTAL GOAL REPRESENTATIONS CAUSALLY INFLUENCE BEHAVIORAL AVOIDANCE: A TMS/fMRI STUDY

Regina Lapate1, Marisa Heckner2, Audrey Phan3, and Mark D’Esposito3
1University of California, 2Research Centre Jülich, 3University of Berkeley

Positive and negative events often promote prepotent action tendencies, such as approach and avoidance behavior. Optimal functioning in everyday life requires the ability to regulate prepotent responses according to one’s goals. Here, we tested whether LPFC task goal representations causally override prepotent emotional responses by combining non-invasive brain stimulation (transcranial magnetic stimulation) and functional neuroimaging (fMRI). Participants (n = 28, 18–28 y old, 16 females) performed an Affective Go/No-Go (AGNG) task in the fMRI scanner. The AGNG task robustly captured approach and avoidance biases, as evidenced by higher accuracy to “no-go” negative (vs. positive) stimuli, and faster reaction times (RTs) in response to “go” positive (vs. negative) stimuli. A linear classifier robustly decoded task rule information from multivoxel LPFC patterns. We targeted the location of peak multivariate rule decoding accuracy within each individual’s LPFC using continuous theta-burst (cTBS) stimulation followed by fMRI scanning. cTBS to LPFC (compared to a control site) significantly increased the strength of classifier decoding of task rule in rostrolateral PFC during negative stimulus processing. Collectively, these results underscore a causal role for LPFC task goal representations in cognitive control and shaping emotionally-guided behavior according to one’s goals.

Funding: NIH F32 MH113347

Symposium 8.2

OPEN AND REPRODUCIBLE SCIENCE IN PSYCHOPHYSIOLOGICAL RESEARCH—CHALLENGES AND EMERGING SOLUTIONS

Session Chair: Tina Lonsdorf
University Medical Center Hamburg-Eppendorf

Descriptors: Multiverse Analyses, Open Science, Methods

This symposium showcases recent examples tackling the ‘replicability’ of ‘Open and Reproducible’ science practices in psychophysiological research. For example, recording, processing and analyzing (psychophysiological) data requires numerous methodological choices. Consequently, a single raw data set can give rise to a multitude of processed data sets (the ‘multiverse’) due to the co-existence of multiple reasonable processing pipelines. This results in unclear comparability, reliability and data quality across pipelines, studies and laboratories. Multiverse analyses meet this challenge by reporting the multiverse of results from running all reasonable pipelines. First, Clayson presents a data multiverse analysis for the error-related negativity (ERN). Second, Keil examines the reliability and reproducibility of emotional distraction effects across pre- and post-processing pipelines from four laboratories spread across three continents. Third, Kuhn presents a multiverse-type of analysis of response quantification approaches for skin conductance responses. Fourth, Lonsdorf shows an inventory of ‘open data’ to illustrate the prospects, status quo and current challenges of data sharing in psychophysiological research. Finally, Larson outlines the impact of using open access publishing formats on article attention (citations and Altmetrics) in electrophysiology research. Together, this symposium showcases the prospects of multiverse analyses for optimizing data processing pipelines in psychophysiology and provides an outlook on how open science can help advancing the field.

A DATA-PROCESSING MULTIVERSE ANALYSIS OF EVENT-RELATED POTENTIALS (ERPs): IMPLICATIONS FOR ERP RELIABILITY, DATA QUALITY, AND EXPERIMENTAL EFFECTS

Peter Clayson1, Scott Baldwin2, Harold Rocha3, and Michael Larson2
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There are numerous methodological choices that must be made when analyzing an event-related potential (ERP), and the same ERP can be examined using different, reasonable pipelines. However, the systematic impact of different pipelines on ERP reliability, data quality, and experimental effects is not typically assessed. A multiverse analysis can be used to shed light on the unique impact of different methodological choices on ERP outcomes. The aim of the present analysis was to examine a data-processing multiverse for the error-related negativity (ERN), and this multiverse focused on two outcomes: data quality (between-trial standard deviations) and experimental effects (correct vs. error). ERP data from 298 healthy young adults were used to determine the impact of different choices at key stages: highpass filtering, lowpass filtering, ocular artifact correction, reference, baseline adjustment, scoring sensors, and measurement procedure. The multiverse analysis yielded 3,456 ERN scores per person, and an optimal pipeline included a .01 Hz highpass filter, 15 Hz lowpass filter, ICA-based ocular artifact correction, and a region of interest approach to scoring. A multiverse analysis provides a rigorous bottom-up approach for optimizing data processing, which would hopefully serve to improve ERP reliability and data quality, ultimately improving the replicability of ERP effects. The proposed process of analyzing the data-processing multiverse paves the way for better refinement, identification, and selection of methodological parameters.

DISTRACTION UNDER COMPETITION: A MULTI-LABORATORY MULTIVERSE STUDY OF LIMITED CAPACITY

Andreas Keil1, Moran Eidelman2, Lior Kritzmann2, Matthias Müller3, Nava Levit-Binnun2, Dean Sabatinelli2, Maeve Boyan1, and Kierstin Riels1
1University of Florida, 2Sagol Center for Brain and Mind Interdisciplinary Center (IDC), 3University of Leizpzig, 4University of Georgia

It is well established that concurrent presentation of multiple stimuli at the same spatial location prompts neural and behavioral interference effects, compared to situations in which each stimulus is presented alone. A growing body of work has used these interference effects to quantify emotional distraction, typically by varying the emotional content of a task-irrelevant cue presented at the same location as a task stimulus. Here we examine the reliability and reproducibility of emotional distraction effects observed across four laboratories in three continents, using the so-called frequency tagging paradigm. In this paradigm, task and distractor cues are flickered at different rates and their neural response is independently quantified using EEG. The task-specific EEG response is robustly decreased when an emotionally engaging, compared to neutral, distractor is present, yielding high effect sizes (Cohen’s $d > .6$). This presentation reports on how effect size, reliability, and reproducibility are affected by pre- and post-processing pipelines, as well as by differences in sample demographics and other site-specific effects. Findings are compared with multiverse, multi-lab analyses with other paradigms showing smaller effects.
Scientific work rests fundamentally upon data, their measurement, processing, analysis, illustration and interpretation. Raw data inevitably have to be processed to be ready for statistical analyses and interpretation. While these processing pipelines can be well defined and standardized, they are often characterized by substantial heterogeneity. Already in 1971, Lykken & Venables raised attention to the “disconcerting diversity of electrodermal measurement technique which, at best, make it difficult to compare one set of results with another and sometimes even casts real doubt on the interpretation of the findings”. Now, exactly half a century later, basically everything has changed with respect to the equipment and techniques used to record SCRs, while on the other hand, the problem of disconcerting methodological diversity identified in 1971 still persists. Here, we first present an inventory on different response quantification approaches for SCRs based on a systematic literature search using fear conditioning research as a case example. Second, we present a set of systematic robustness analyses (i.e., multiverse analyses) for which we applied different identified approaches to two existing data-sets with \( N = 118 \) and \( N = 38 \). We discuss the results in terms of robustness and replicability and provide insights into challenges and potential solutions including the adherance to the FAIR principles of open access: being findable, accesible, interoperable and reusable. I will present the results with respect to their adherence to the FAIR principles of open data: being findable, accessible, interoperable and reusable. I will present the results of this inventory, outline the challenges identified and provide a detailed outlook into the future by suggesting and discussing potential solutions on how to use publicly available data in psychophysiological research to their full potential.
**BIG IDEAS SESSION #1: PHYSICAL & MENTAL HEALTH**

**CAN INHIBITORY CONTROL TRAINING REDUCE WEIGHT AND CALORIC INTAKE? A RANDOMIZED CONTROLLED EVENT-RELATED POTENTIAL STUDY**

Kaylie Carbine\(^1\), James LeCheminant\(^2\), Scott Baldwin\(^2\), Chad Jensen\(^2\), C. Brock Kirwan\(^3\), and Michael Larson\(^4\)

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**Descriptors:** N2 ERP, Inhibitory Control Training, Heart

The negative effects of overweight and obesity on health are well known. Inhibitory control training (training individuals to withhold dominant responses) may reduce food intake and weight, but long-term effects and changes in neural indices of inhibition are unknown. We conducted a randomized controlled trial where individuals with overweight and obesity (N = 100; 53 female; Mage = 28.1) completed a generic or food-specific inhibitory control training once a day, four days a week, for four weeks. Weight and caloric intake were collected at baseline, following the four weeks, and 12-weeks after. N2 amplitude (an event-related potential that is more negative when withholding a dominant response) during food and neutral go/no-go tasks was collected as a measure of inhibition. In mixed models, N2 amplitude to food cues, weight, and caloric intake did not change (p > .06). In regression analyses, individuals in the food group compared to generic group lost more weight (p = .04), and individuals with a smaller food-specific N2 amplitude at baseline showed a greater decrease in caloric intake (p = .01). While there may be a slight benefit in weight loss due to food-specific inhibitory control training, inhibitory control training seems to be more effective in reducing caloric intake for individuals with a smaller inhibitory response to food. Inhibitory control training does not seem to affect neural indices of inhibition; the reduction in caloric intake may be due to inhibitory control training targeting other mediating cognitive processes.

**Funding:** American Psychological Foundation (APF) graduate student grants

**USING BRAIN EVENT-RELATED POTENTIALS TO DIFFERENTIATE DISTINCT SYMPTOM FACETS OF ALCOHOL USE DISORDER**

Keenan Joyner\(^2\), Ashley Watts\(^2\), and Christopher Patrick\(^1\)

\(^1\)Florida State University, \(^2\)University of Missouri, Columbia

**Descriptors:** Alcohol Use Disorder, Event-related Potentials

Alcohol Use Disorder (AUD) is a unique mental health phenomenon because the effects of AUDs span both mental and physical health due to the direct pharmacologic effects of alcohol. There is tremendous heterogeneity in symptoms of AUD, and studies using genetically informed (e.g., twin) designs suggest there are distinct genetic risk factors contributing to (1) tolerance and heavy use, (2) loss of control and use despite problems, and (3) withdrawal and perception of problems (Kendler et al., 2012). The current work used data from two samples (combined N ~ 700) to examine whether these 3 facets of AUD symptomology, shown to reflect different genetic risk factors, differ in their relations with brain event-related potential (ERP) measures. The three AUD facets were quantified using a structured clinical interview and a self-report inventory, the Alcohol Dependence Scale. Oddball-task P3 amplitudes and N2 ERP response to affective pictures related most to the third (withdrawal) facet. Using data for one of the study samples, composed of twins (n = 500), biometric modeling analyses will be performed to assess for a heritable basis to the observed relations between brain-ERP measures and AUD symptom facets. Findings will be discussed in terms of their implications for understanding the heterogeneity of AUD, improving upon existing assessment protocols, and optimizing methods of treatment.

**FATIGUE IS ASSOCIATED WITH DIMINISHED CARDIOVASCULAR RESPONSE TO ANTICIPATORY STRESS IN PATIENTS WITH CORONARY ARTERY DISEASE**

Julija Gecaite-Stonciene\(^1\), Brian Hughes\(^2\), Julius Burkanskas\(^3\), Adomas Bunevicius\(^1\), Nijole Kazukauskiene\(^1\), Liisanne van Houtum\(^1\), Julija Brozaiiene\(^3\), Julius Neverauskas\(^3\), and Narseta Mickuviene\(^3\)

\(^1\)Lithuanian University of Health Sciences, \(^2\)National University of Ireland \(^3\)Leiden University

**Descriptors:** Cardiovascular Response to Stress, Fatigue, Coronary Artery Disease

High levels of stress and fatigue are known to be problematic in individuals with coronary artery disease (CAD). However, studies exploring the interaction between these variables are scarce and inconsistent. Thus, we aimed to investigate the links between cardiovascular response (CR) to mental stress and fatigue in CAD patients. This cross-sectional study investigated 142 CAD individuals (85% males, 52 ± 8 years) within 2-3 weeks after acute coronary syndrome. Participants completed the Multidimensional Fatigue Inventory 20-items, the Hospital Anxiety and Depression scale and the Type D Scale-14, CR to stress (i.e., systolic [S] and diastolic [D] blood pressure [SBP, DBP], and heart rate [HR]) was evaluated during Trier Social Stress Test (TSST). Multivariable linear regression analyses were used to evaluate links between subjective fatigue and CR to TSST, while controlling for covariates (i.e., baseline cardiovascular measures, age, gender, education, heart failure severity, arterial hypertension, smoking history, use of nitrates, anxiety and depressive symptoms, Type D Personality, and perceived task difficulty/efforts). Results indicated that CR to anticipatory stress was inversely linked with global fatigue (deltaHR: beta = −0.238; p = .04) and mental fatigue (deltaSBP: beta = −0.244; p = 0.04; deltaHR beta = −0.303; p = 0.01) as well as total fatigue score (deltaSBP: beta = −0.331; p = 0.01; deltaHR: beta = −0.324; p = 0.01). To our knowledge, this is the first study to investigate psychophysiological stress response and its relationship with fatigue in an acutely ill cardiac population.

**A THREE-WEEK EXECUTIVE CONTROL TRAINING ENHANCES INTERFERENCE CONTROL AND REDUCES ERN AMPLITUDES IN PATIENTS WITH OCD**

Rosa Grützmann\(^1\), Norbert Kothmann\(^1\), and Stephan Heinzel\(^2\)

\(^1\)Humboldt University, \(^2\)Freie Universität

**Descriptors:** Cognitive Training, ERN, Obsessive-compulsive-disorder

The error-related negativity (ERN), an ERP correlate of error monitoring, is robustly increased in patients with internalizing disorders such as obsessive-compulsive disorder (OCD) and anxiety disorders. As the ERN is also increased in unaffected first-degree relatives of index patients and prospectively predicts symptom development and disorder onset, it fulfills criteria for a transdiagnostic risk marker and thus poses a promising target for interventions. In the present study, we investigated the effects of three-week executive control training, comprising a flanker task and an n-back task, on interference control and performance monitoring in OCD. At baseline, patients showed an accuracy-focused response style evident in prolonged response times in incompatible and compatible correct trials compared to healthy controls. After training, response times were significantly reduced and, as a consequence, normalized in OCD patients. Additionally, baseline data confirmed increased ERN amplitudes in OCD patients. After training, the ERN was significantly reduced. Importantly, this led to a normalization of the ERN in OCD patients. Additional training effects were observed for the correct-related negativity, which was reduced after training, and the N2, which was increased after training. Taken together these data illustrate that the executive control training results in shift from response-locked to stimulus-locked cognitive control. Successful normalization of baseline deficits in OCD indicates that the training poses a fruitful intervention for therapy augmentation.

**Funding:** German Research Foundation (DFG) grant GR 490/2-1 and HE 7464/4-1
PROLONGED POSITIVE EMOTIONAL RESPONSES MEASURED WITH FACIAL EMG: A MEASURE OF RESILIENCE

Stacey Schaefer, Lauren Gresham, Sterling Johnson, and Richard Davidson
University of Wisconsin, Madison

Descriptors: Positive Emotion, Corrugator Electromyography, Resilience Psychophysiological responses to emotional stimuli were measured with corrugator electromyography in multiple samples to assess the import of the time course of positive and negative emotional responses for health and wellbeing. Responses to emotional stimuli as well as levels of perceived stress and mental health symptoms were measured prior to the COVID-19 pandemic in one sample (n = 78, aged 25-65). Symptom levels were reassessed during the pandemic (fall, 2020). Compared to those who exhibited blunted positive emotional responses prior to the pandemic, those who exhibited prolonged positive responses that lingered after positive stimulus offset showed less of an increase in their perceived stress, anxiety, and depression during the pandemic. No correlations were found with negative responses. This same emotional response paradigm was collected in the Wisconsin Registry for Alzheimer Prevention (n = 91, aged 51-78) to assess how the time course of emotional responses may be associated with cognitive impairment and Alzheimer’s disease pathology. Better cognitive performance on a preclinical Alzheimer’s cognitive composite, sensitive to early and late cognitive decline during preclinical stages, was associated with prolonged positive emotional responses. Again, no relation was found with negative responses. These findings suggest that positive affect disruptions may leave one vulnerable to chronic stress as well as early cognitive change in AD. Interventions and therapies targeting the ability to savor positive emotions may be an important way to build resilience.

Funding: National Institute on Mental Health (R01 MH043454) to RJD and SMS, and National Institute on Mental Health and National Institute on Aging (R21 MH113227) to SMS.

CEREBROVASCULAR REACTIVITY IN AGING: MEASURES OF TIMING AND AMPLITUDE PREDICT BRAIN AND COGNITIVE HEALTH

Benjamin Zimmerman, Kathy Low, Grace Clements, Daniel Bowie, Hannah Jones, Samantha Rubenstein, Gabrielle Gratton, and Monica Fabiani
University of Illinois, Urbana-Champaign

Descriptors: Aging, Cerebrovascular Reactivity, Cerebrovascular Health Cerebrovascular health is an important predictor of cognitive integrity in aging, but details of how cerebrovascular health affects cognition are still lacking. Possibly, impairments in cerebrovascular reactivity (CVR) lead to dysregulated neuromotor coupling and bouts of insufficient blood flow. MRI measures of the blood-oxygen-level-dependent (BOLD) signal during hypercapnia allow us to quantify blood flow changes associated with CVR. Diffuse optical tomography measures of the cerebral arterial pulse (pulse-DOT) allow us to quantify CVR-related vasodilation phenomena. In a cohort of 50-70 year olds, we investigated the relationship between these two measures, as well as with cognitive and other physiological measures. Both BOLD and pulse-DOT measures were sensitive to the phase of the hypercapnia challenge. The dynamics of pulse-DOT reactivity during the hypercapnia challenge are related to baseline estimates of cerebral arterial elasticity, which is known to predict cognitive outcomes in aging. BOLD measures were associated with better performance on an executive function task. This shows that CVR variance in ages 50-70 may predict brain health and cognition, and that temporal variability in the response to hypercapnia provides rich physiological information. These findings have important implications for the interpretation of the BOLD signal in aging and for identifying risk factors for age-related cognitive dysfunction. Future research should explore the regional and temporal variance in response to hypercapnia as an index of cerebrovascular function.

Funding: This work was supported by NIA grant R01AG059878 to M. Fabiani and G. Gratton.

BIG IDEAS SESSION #2: PSYCHOPHYSIOLOGY ACROSS THE LIFESPAN

CHILDHOOD FAMILY STRESS AND WOMEN’S HEALTH: RESPIRATORY SINUS ARRHYTHMIA STRESS REACTIVITY AS RISK AND RESILIENCE FACTORS

Li Shen Chong, Anna Yeo, and Betty Lin
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Descriptors: Childhood Family Stress, Women's Health, Respiratory Sinus Arrhythmia Childhood family stress (CFS) exacerbates risk for health problems across the lifespan. Women endorse more CFS than men, and greater CFS in women was linked to gendered health disparities. Parasympathetic functioning, which can be indexed using Respiratory sinus arrhythmia (RSA), may modulate the impact of early adversity on women’s health outcomes. Specifically, a decrease in RSA reactivity to stress situations and fast RSA recovery (back to baseline) post-stress promote adaptive arousal and regulation of the body’s responses to stress. Nevertheless, little is known about the role of RSA reactivity in women’s health. This study aimed to examine whether RSA reactivity and recovery would moderate the link between CFS and health problems in a sample of female college students (N = 68. Mean age = 19.44). Participants self-reported CFS and health problems. RSA reactivity and recovery were assessed during a mild laboratory-based stress task. Multiple regression models indicated that CFS was significantly associated with poorer health. Further, RSA reactivity and recovery significantly moderated the link between CFS and women’s health. Specifically, more CFS was only significantly associated with poorer health among women who showed greater decreases in RSA in response to the TSST. In contrast, the more CFS was only associated with poorer health among women who showed greater increases in RSA during post-TSST recovery. Findings highlight the importance of the interaction between biological functioning and psychosocial stress in understanding the impact of CFS on women’s health.

CEREBROVASCULAR REACTIVITY IN AGING: MEASURES OF TIMING AND AMPLITUDE PREDICT BRAIN AND COGNITIVE HEALTH

Benjamin Zimmerman, Kathy Low, Grace Clements, Daniel Bowie, Hannah Jones, Samantha Rubenstein, Gabrielle Gratton, and Monica Fabiani
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Funding: This work was supported by NIA grant R01AG059878 to M. Fabiani and G. Gratton.

TRANSIENT DYNAMICS OF RESTING-STATE MEG NETWORKS IN COGNITIVE AGEING

Roni Tibon, Kamen Tsvetanov, Darren Price, David Nesbitt, and Richard Henson
University of Cambridge

Descriptors: Magnetoencephalography (MEG), Resting-state, Cognitive Aging In order to support cognitive functioning, brain networks need to flexibly reorganize and coordinate over a millisecond time-scale. This ability might play an important role in the maintenance of cognitive function in old age, yet it had been overlooked due to limitations of previous data and methods. Magnetoencephalography (MEG) provides the required temporal resolution to investigate transient dynamics of neural networks. We applied Hidden Markov Models (HMMs) to resting-state MEG data from a large cohort (Cam-CAN; N = 594) of population-based adults (aged 18-88), who also completed a range of cognitive tasks. Both age and decreased fluid intelligence were associated with reduced occurrence of “lower-order” brain networks, coupled with increased occurrence of “higher-order” networks. These findings are less consistent with theories of functional compensation in ageing, and instead support theories of reduced neural efficiency.

Funding: The Cambridge Centre for Ageing and Neuroscience (Cam-CAN) research was supported by the Biotechnology and Biological Sciences Research Council (BB/H008217/1); R.T is supported by a British Academy Postdoctoral Fellowship (SUAI0028 RG94188; PF170046); K.A.T is supported by British Academy (PF160048) and the Guarantors of Brain (G101149); R.H is supported by a UK Medical Research Council grant (SUAG010 RG91365).
AGE-RELATED REDUCTIONS IN NEURAL SELECTIVITY: EVIDENCE FROM EEG

Rachelle Pichot, Daniel Henreckson, Morgan Foley, and Joshua Koen
University of Notre Dame

Descriptors: Neural Dedifferentiation, Cognitive Aging, Aperiodic Activity

There is a growing body of work showing that age-related neural dedifferentiation—reductions in the selectivity and precision of neural representations—contributes to cognitive aging. This research has primarily used fMRI to examine age-related reductions in neural selectivity for different categories of visual stimuli. Unlike fMRI, the temporal resolution of EEG permits examination of whether neural dedifferentiation results from an age-related reduction in ‘maximal’ levels of neural selectivity, a delay in the time the maximal neural selectivity, or both. The present research examined age-related neural dedifferentiation by examining scene-sensitive (P200) and face-sensitive (N170) ERP components. Young (N = 44) and older (N = 44) adults viewed images of scenes, objects, and faces. Relative to young adults, the P200 in older adults was significantly reduced in peak amplitude and delayed in peak latency. A similar pattern was observed for the N170 but only over right hemisphere electrodes. We also tested a prediction from a computational model proposing that age-related neural dedifferentiation results from age increases in “neural noise” (i.e., the aperiodic signal). However, we did not support this prediction. There was no clear relationship between the aperiodic signal and noise” (i.e., the aperiodic signal). However, we did not support this prediction. Howe...

Funding: This research was funded by a National Institute on Aging grant (R56AG068149) awarded to J.D. Koen.

APERIODIC EEG POWER SPECTRUM PREDICTS ADHD RISK IN INFANCY AND ADOLESCENCE

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Descriptors: ADHD, Infancy, EEG Risk Markers

Attention-deficit/hyperactivity disorder (ADHD) is a neurodevelopmental disorder with liability in early life. Identifying physiological indices of early risk can facilitate prevention efforts. During later development, physiological measures may aid diagnosis, predict treatment response, and differentiate clinical course. Theoretically-motivated, objective markers for ADHD that can be measured across a wide developmental span are needed. Here we investigate a novel measure, the aperiodic exponent of the EEG power spectrum, recorded during a resting baseline in well-characterized infants (n = 69, 1-month-old, 32-channels) and adolescents (n = 262, ages 11-17 years, 32- and 64-channels). Results demonstrate good internal consistency at both ages (r = .54–.99 with varying amounts of data and number of electrodes). In infancy, a larger aperiodic exponent predicted greater family history of ADHD and less infant positive affect (betas = .55, -.31). In adolescence, a smaller aperiodic exponent predicted ADHD diagnosis (beta = -.32), but only in children who had never received stimulant medication. A smaller aperiodic exponent in adolescence also predicted greater negative affect, higher activity levels, and worse cognitive impairment on computerized attention tests (betas = .11–.17). Together, findings imply a dynamic shift in which the developmentally-normative flattening of the EEG power spectrum is exaggerated in ADHD, potentially reflecting imbalances in cortical excitation and inhibition. These disruptions in cortical development may be detectable shortly after birth.

Funding: Funding was provided by the National Institutes of Health R01 MH124824 (MPI: Nigg/Sullivan), K01 MH120507 (PI: Gustafsson), R37 MH99105 (PI: Nigg), and K23 MH108656 (PI: Karalunas), as well as by a Psychiatry Seed Grant from Oregon Health & Sciences University (PI: Karalunas).

HOW THE HEART HELPS TO DEAL WITH UNFAMILIAR OTHERS – RESTING HEART RATE VARIABILITY’S BENEFITS FOR DISTANCED SOCIAL INTERACTIONS

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Descriptors: Heart Rate Variability, Emotion Regulation, Social Interaction

Resting heart rate variability (HRV) has been suggested to index adaptive regulation during social encounters. Yet, the benefits of HRV may vary with regard to the meaningfulness of the social exchange. As distanced social interactions require more regulatory efforts than intimate social interactions, we assumed that the association between HRV and emotional well-being is moderated by the perceived intimacy of the exchange. To examine this assumption, we recorded 144 participants’ (38 men; M_age = 28.0 years; SD_age = 7.05 years) resting HRV in the laboratory. Subsequently, we measured participants’ emotional well-being across a broad range of naturally occurring social interactions using an experience-sampling methodology. In accordance with our expectation, we could find that high HRV is particularly relevant for emotional well-being in distanced social interactions. This study contributes to a better understanding of the benefits of HRV and thereby promotes future research in this area.

Funding: Data collection of this study was supported by grant no. 2016/23/G/HS6/01397 from the National Science Centre, Poland, to Anna Czarna.
EVERYBODY GETS A SECOND CHANCE, THE CIRCUMSTANCE TO GET REJECTED? THE INFLUENCE OF A SECOND OFFER IN THE ULTIMATUM GAME ON DECISION MAKING AND EEG FEEDBACK RESPONSES

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Descriptors: Feedback Related Negativity (FRN) to Unfair Offers, Midfrontal Theta Activation Predicting Decisions, Ultimatum Game: 2-stage Version

In economic neuroscience, the ultimatum game (UG) is often used to simulate bargaining behavior. In real life, however, there are only few interactions that cannot be adjusted. Therefore, we implemented a 2-stage UG and investigated 92 participants to determine the influence of an additional offer after a previous rejection on the acceptance rates and the electro-cortical responses of participants to fair and unfair offers. Also, we investigated the influence of relevant traits like anxiety and greed on these effects. We found that an additional stage led to more rejection in the first stage of the 2-stage UG and that the FRN to unfairness was dampened in this first stage. FRN, as an electro-cortical correlate of fairness perception was no significant predictor for rejection behavior. However, theta band activation representing cognitive control, led to more acceptance in the 2-stage UG, due to the cognitive control needed to overcome the “default” of rejecting the offer and wait for a second one. This hints to different processes, an evaluation of expectancy or fairness in FRN and the theta band activation as a correlate of cognitive control. Concerning individual differences, we found that in the second stage of the UG, high trait greed led to more acceptance of unfair offers while low trait anxiety led to more rejection of these unfair offers. The study shows the advantage of including a second stage in the UG for investigating bargaining behavior and it provides insights about electro-cortical correlates and trait moderations of bargaining responses.

Funding: European Union through the project “Individualisierung Digital” (Fonds S28881) in the “Europäischer Fonds für regionale Entwicklung” (EFRE).

EFFECTS OF NATURE EXPOSURE ON EEG INDICES OF COGNITIVE CONTROL

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1University of Utah, 2University of California, Merced

Descriptors: Cognitive Control, Attention, ERP

Attention Restoration Theory suggests that time spent outside in nature improves one’s ability to successfully complete cognitively demanding tasks. There is behavioral evidence to support this claim, but the use of electrophysiology is a useful converging method. EEG is a feasible and portable method for collecting data while participants spend time outside in nature. In the present work, we examine how ERP measures of cognitive control might change as a result of exposure to nature. We specifically test how the ERN, the stimulus-related conflict N2, and stimulus-locked midline frontal theta change in response to nature. We employ a within-subjects design, in which participants (N = 60) complete the same experimental flanker task while EEG is recorded at a baseline lab test, on a 5-day camping trip to Southern Utah, and at a 2 week follow up post-test in lab. Both of these EEG measures is strongly linked to cognitive control, such that an increase in the N2 or midline frontal theta typically reflects an increase in cognitive control resources allocated to the current task. Therefore, we hypothesized to see an increase in all three cognitive control measures of EEG in nature. Preliminary pilot data suggests an increased availability of attentional resources for cognitive control when participants spend time outside in nature; results of a pending registered report will also be discussed.

EXAMINING PSYCHOPHYSIOLOGICAL INDICES OF AFFECTIVE CHRONOMETRY ACROSS THE LIFESPAN USING MIDUS DATA

Anna Finley1, Carien van Reekum2, Richard Davidson1, and Stacey Schaefker1
1University of Wisconsin, Madison, 2University of Reading

Descriptors: Facial EMG, Corrugator, Startle Eyeblink

The trajectory of psychophysiological reactivity to and recovery from emotional images is examined in participants ages 26 to 84 (M = 52.84, SD = 11.46) from n = 353 participants with startle eyeblink data and n = 407 participants with corrugator electromyography (EMG) data from the Midlife in the United States (MIDUS) study. Participants viewed positive, negative, and neutral pictures for 4 seconds with startle probes occurring at 2,900 ms after image onset (reactivity) and 1,900 ms after image offset (recovery). Corrugator activity was assessed in 3 four-second epochs (reactivity = 0–4 s during image presentation, early recovery = 0–4 s from image offset, and late recovery = 4–8 s after image offset). Separate cluster-correlated nonparametric repeated measures regressions with percentile bootstrapping were conducted to examine the effect of valence, time, age, and their interactions. Significant three-way interactions were found for both analyses. Older adults show both lower corrugator reactivity to negative images and greater corrugator activity in the late recovery period after positive images compared to younger adults. Additionally, while younger adults show the standard emotion-modulated startle eyeblink response, older adults did not show differentiation between startles during positive and neutral images. These nuanced shifts in emotional reactivity and recovery across adulthood highlights the importance of measuring the psychophysiology of affective chronometry throughout the lifespan to inform theories of emotion and aging.

Funding: The MIDUS Neuroscience Project was funded by: National Institute on Aging (P01-AG020166, U19-AG053426), Waismann Intellectual and Developmental Disabilities Research Center (U54-HD090256) awarded by the National Institute of Child Health and Human Development.
FRONTAL-CEREBELLAR EEG SOURCE LOCALIZATION AND FUNCTIONAL CONNECTIVITY DURING INHIBITORY CONTROL DIFFERENTIATES HEALTHY ELDERS BY APOLIPOPROTEIN-E ɛ4: A PILOT STUDY

Elizabeth Paitel and Kristy Nielson
Marquette University

Descriptors: Source Localization, Functional Connectivity, Apolipoprotein-E E4

Functional recruitment in the frontal lobes has been linked to healthy older adult carriers of the Apolipoprotein-E ɛ4 allele (ɛ4+), a primary risk factor for Alzheimer’s disease (AD). Yet, recent studies show the cerebellum exhibits even earlier changes associated with AD risk. Complex sensorimotor tasks, such as inhibitory control tasks, in fact rely on both frontal and cerebellar regions and their intercommunication. Such tasks might be able to detect the earliest signs of AD risk, even in cognitively healthy elders, a key step for early treatment. EEG further allows temporally precise analysis of functional network activity and revolutionary new findings show it can also effectively isolate cerebellar activation. Thus, in this pilot study, novel source localization and functional connectivity were examined in healthy, cognitively intact older adults (3 ɛ4+, 3 ɛ4−) during a stop-signal inhibition task. ɛ4+ had greater left inferior frontal gyrus (IFG) and precentral gyrus activation during the N200 window (conflict monitoring), while ɛ4− had greater right IFG activation during the P300 window (response inhibition, performance evaluation) and in all cerebellar regions. Indeed, extensive frontal-cerebellar connectivity was evident during the P300 window in ɛ4+, which was lacking in ɛ4+. Thus, we reinforce evidence that cerebellar activity and its functional connectivity with frontal cortex are robust using EEG, and we provide preliminary evidence that the millisecond-level precision of EEG may be sensitive to the earliest prodromal neurophysiological indicators of AD risk.

Funding: This study was supported by an Arthur J. Schmitt Fellowship at Marquette University (E.R. Paitel) and a private contribution from Thomas J. Salentine to the Aging, Imaging and Memory Lab at Marquette University (K.A. Nielson, Director).

RESONANCE BREATHING CAN IMPROVE INTEROCEPTIVE AWARENESS

Mateo Leganes-Fonteneau, Marsha Bates, Evgeny Vaschillo, and Jennifer Buckman
Rutgers University

Descriptors: Interoception, Resonance Breathing, Heart Rate Variability

Interoception, the ability to perceive internal bodily sensations, and heart rate variability (HRV) share common psycho-physiological pathways underlying the characterisation of mental health disorders. Here we examine if resonance breathing can improve interoceptive awareness. In a two-session laboratory study (n = 63) interoception was measured using the cardiac discrimination task. Baroreflex function was measured as HRV at 0.1 Hz (a proxy of baroreflex activation) and baroreflex sensitivity (BRS). Cardiovascular indices were measured during a low cognitive demand baseline task and during a resonance and control paced breathing tasks, after which changes in interoception were measured. We found that changes in 0.1 Hz HRV and BRS during resonance breathing positively correlate with increases in cardiac interoception after the paced breathing task. That is, the extent to which paced breathing engages the resonant properties of the cardiovascular system facilitates the perception of participants’ own heartbeat. This research bridges the fields of interoception and cardiovascular functioning to provide a new window to the application of resonance breathing to mental health disorders. It also provides a novel characterisation of the cardiovascular basis of interoceptive awareness and advances our understanding of the mechanisms by which the brain integrates interoceptive signals.

AUGMENTED REALITY FOR PSYCHOPHYSIOLOGY AND PSYCHOTHERAPY: CURRENT REALITY AND FUTURE POSSIBILITIES

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Descriptors: Augmented Reality, EEG/ERP, Mental Disorders

Since the early 2000s, many clinical studies have used virtual reality (VR) as an intervention tool for mental illness, such as PTSD, anxiety, phobia, and schizophrenia. Recent technological advancements combining EEG with VR now provide an opportunity to detect changes in brain activity during VR interventions. However, limitations persist with VR, namely motion sickness, eye fatigue, headaches, and sweating; graphical environments do not truly reflect “our world”, and participants cannot see their own bodies, which creates a sense of disembodiment. An alternative to VR is Augmented Reality (AR), an interactive experience where the objects that reside in the real-world are “augmented” by computer-generated perceptual information using special optic glasses. Rather than completely replacing the patient’s real-world environment with a simulated one, AR is seamlessly interwoven with the physical world and alters one’s ongoing perception of the real-world. Thus, key strengths of combined EEG and AR include the flexibility and manipulability of the real-world and facilitating interventions and EEG tasks that have been prohibitively difficult to implement until now. Here, I will discuss the latest advancements in combining EEG/ERP recordings with AR, and it be used to investigate EEG correlates of reward processing (reward positivity), cognitive control (frontal-midline theta) and memory (theta), and discuss future directions of EEG-AR in the context of advancing our understanding and treatment of mental disorders, with a special focus on addictions and trauma.

Funding: Rutgers Research Council Grant

USING THE LPP AND P3B TO CAPTURE AUTOMATIC ASSOCIATIONS OF EXERCISE-RELATED IMAGES

Andrew Ude1, Hannah Purduel1, Sayaka Carpenter1, Matthew Miller2, and Brandon Alderman1
1Rutgers University, 2Auburn University

Descriptors: Physical Activity, Automatic Associations, Implicit Attitudes

Over 60% of the world’s population lead sedentary lifestyles, resulting in increased risk of chronic disease. Previous research indicates favorable attitudes toward exercise may serve as strong predictors of exercise intentions. However, automatic or implicit attitudes toward exercise remain relatively unstudied. We used EEG to assess multiple measures of automatic associations to exercise-related images, as potential indices of motivation and intention to engage in physical activity or exercise. Forty college-aged adults viewed exercise-related images depicting varied physical activity behaviors in two separate tasks. A passive viewing paradigm with standard IAPS images interspersed with exercise-related images was administered to elicit the LPP. Participants also completed a visual oddball task with exercise images embedded as infrequent targets among positive, negative, or neutral images. Exercise images elicited a smaller LPP amplitude than both positive and negative images and was not significantly different from neutral images. Further analysis of exercise image-types revealed a larger LPP to exercise performed in small groups compared to images reflecting outdoor activity or gym-based exercise. The smallest P3b amplitudes were observed when exercise images were embedded within positive images. LPP and P3b may be useful to index automatic processes towards exercise, particularly in more active individuals. Exploratory analyses indicate that the type of exercise displayed may moderate these automatic associations.
A FRIENDLY TOUCH SUPPORTS, A COLD TOUCH FRIGHTENS: SOCIAL SUPPORT DURING INSTRUCTED FEAR OF SHOCK

Stephen Benning1 and Stephany Molina2
1University of Nevada, 2Bridgewater State Hospital

Descriptors: Interpersonal Touch, Startle Blink, Postauricular Reflex

During the COVID-19 pandemic, the necessity of physical touch for human well-being has become ever more evident. Psychopathic meanness—invoking Malice (a misuse of others and disregard for their rights), Coldness (an unempathetic disconnection from others), or Imperviousness (a lack of socially mediated negative emotions)—might reduce this benefit. A sample of 83 undergraduate participants were instructed that they would be shocked during 20% of letters of one color and shocked during 0% of letters in another color. During one block of trials, a friend sat behind the participant and put their right hand on the participant’s left shoulder; in the other block, the participant was left alone. Startle blink and postauricular reflexes were collected to assess defensive and positive emotional processing, respectively. Startle blink magnitude was larger during threat of shock than during safety, F(1, 74) = 5.45, p = .022, d = .27. It was also smaller with a friend than when alone, F(1, 74) = 8.06, p = .006, d = −.33. Conversely, postauricular reflex magnitude was larger with a friend than when alone, F(1, 72) = 19.1, p < .001, d = .51. Participants’ meanness scores did not correlate with reflex magnitude differences between the alone and friend conditions, r(ps) < .12, ps > .38. Thus, the touch of a friend higher in Coldness heightened defensive reactivity without reducing benefits of social support.

SWEATING THE BIG STUFF: AROUSAL AND STRESS AS FUNCTIONS OF SELF-UNCERTAINTY AND IDENTIFICATION

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1Texas Tech University, 2U.S. Army Aeromedical Research Laboratory

Descriptors: Self-uncertainty, Identification, Groups

Groups serve a variety of crucial functions, one of which is the provision of an identity and belief system that impart self-referent information, thereby reducing self-uncertainty. Iterative groups are more attractive for highly uncertain participants seeking groups for identification and thereby reducing self-uncertainty. Entitative groups are more attractive by sources in the external world, such as other people. Here, across two studies, participants evaluated the trustworthiness of consciously seen target faces that were paired with positive, negative, or neutral affective stimuli suppressed from reportable awareness. Results revealed that targets were evaluated as more trustworthy when paired with suppressed positive than suppressed negative stimuli, and that this effect was strongest when the two images were presented concurrently as opposed to offset in time (100–150 ms). Critical, the influence of suppressed affective stimuli on participants’ bodily arousal (i.e., their heart rate) and their subjective affective experience (i.e., self-reported experience of pleasantness/unpleasantness and activation/deactivation) were not impacted by the relative timing of the target faces and the suppressed affective stimuli in this same way. Moreover, individuals with greater interoceptive awareness (as measured by a heartbeat tracking task) were less susceptible to affective realism effects (i.e., they showed a less pronounced impact of affect on trust ratings of social others), but they also exhibited more pronounced changes in subjective affective experience. This pattern of findings suggests that interoceptive awareness may moderate the extent to which individuals experience their affect as derived from the self or the body vs. as caused by sources in the external world, such as other people.
EFFECTS OF NEURAL SYNCHRONY ON REACTIONS TO INTERGROUP THREAT: PRELIMINARY EVIDENCE

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¹University of Missouri-St. Louis, ²University of Newcastle

Descriptors: Intergroup Threat, Neural Synchrony, Physiological Reactivity

Social identity threat negatively affects stigmatized groups. Neural synchrony is a promising area of research that may help us better understand positive intergroup contact. This study examined effects of neural synchrony on performance and physiological reactivity among 7 mixed-gender dyads interacting in a group problem solving task. The dyad worked with two male confederates who made a sexist comment in the threat condition, or no comment in the control condition. Results indicate marginally better task performance among women in the control group with higher neural synchrony, \( r(1) = .943, p = .108 \). Men showed a similar pattern, \( r(1) = .984, p = .057 \). Under threat, women performed poorly on the task when they were not in sync with their partner, \( r(2) = -.996, p = .029 \). Men showed a similar pattern, \( r(2) = -.826, p = .087 \). Women under threat showed higher PEP when they were less synced, \( r(2) = -.965, p = .017 \), reflecting a threat response. Men did not show differences in PEP; however, men in the threat condition had higher RSA during the task when they were less synced with their partner, \( r(2) = -.859, p = .07 \), reflecting a threat state. There were no effects of RSA for women, nor effects in the control condition. The results provide preliminary evidence of the benefits of neural synchrony among mixed-gender dyads in threatening intergroup interactions. Research on the effects of neural synchrony within mixed-group dyads (gender, race) can advance our understanding of the conditions under which intergroup contact can be beneficial or harmful.

Funding: National Institutes of Health [R01GM094536].
EXPOSURE TO EARLY LIFE STRESS MODERATES THE RELATIONSHIP BETWEEN AGE AND INHIBITORY P300 AMPLITUDE IN HEALTHY YOUNG AND OLDER ADULTS

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1Marquette University, 2St. Norbert College

Descriptors: Event-related Potentials, Cognitive Aging, Early-life Stress

Deficits in inhibitory control are common with advancing age and may underlie declines in other complex cognitive functions. The inhibitory P300 event-related potential (ERP) generally decreases in amplitude with age, reflecting deficits in response inhibition and performance evaluation, with possible generators including precentral and inferior frontal gyri and midcingulate and parietal cortex. Individuals with exposure to early life stress (ELS) also show deficits in inhibitory control, smaller P300 amplitudes, and dysfunction in regions associated with P300 generation. Although psychosocial effects of ELS are evident in older adulthood, it is unclear how ELS influences neural processes in later life. In the current study, 13 young (M_age = 19.92) and 21 healthy older adults (M_age = 71.43) completed a go/no-go task with comparable group accuracy and the Juvenile Victimization Questionnaire (JVQ; prior to age 18), an indicator of ELS. P300 amplitudes during successful inhibition were predicted by age, which was moderated by JVQ score. Centro-parietal P300 amplitudes were larger in younger adults, but only in those with low to moderate JVQ scores. P300 did not significantly differ by age in those with higher JVQ scores. Specifically, those with greater ELS had smaller P300 amplitudes in young adulthood and larger P300 amplitudes in older adulthood, indicating possible compensatory mechanisms. These findings suggest that ELS influences neural functioning differentially in early and later adulthood and should be considered when investigating neuro-cognitive aging processes.

AGE RELATED CHANGES IN ERROR DETECTION AND RESPONSE CORRECTION

Emily Norton and Paul Kieffaber

Descriptors: EEG, Error Commission, Error Correction

Older adults have been shown to exhibit increased rates of error commission on cognitive tasks compared to younger adults; however, this literature typically neglects measures of corrective responses with respect to error initiation and subsequent error commission or correction. Detection of errors at the initiation of movement and the subsequent correction of errors have previously been linked with the error related negativity (ERN) and error positivity (PE) components of the ERP respectively. The present research aimed to determine the effects of aging on the ERP correlates of error initiation and response correction while participants performed an attention-switching task. If increased error commission by older adults is a function of poor error detection, then fewer corrected errors and reduced amplitude ERN but similar amplitude PE are expected. However, if increased error rates are due to diminished error correction, then fewer corrected errors combined with equivalent ERN and reduced PE at the point of correction are expected. Results indicated that older adults committed more errors and made fewer corrections than younger adults. Moreover, there was a significant difference in ERN amplitude between younger and older adults when measured at the initiation of a response. However, there were significant differences in the negative-going component of the ERN/PE-like ERP complex at the point of movement correction. Together, these findings suggest that error detection, but not error correction are preserved during the normal aging process.

COMPENSATORY RESPONSE INHIBITION-RELATED BETA POWER DIFFERENTIATES COGNITIVELY INTACT OLDER ADULTS AT RISK FOR ALZHEIMER'S DISEASE

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Descriptors: Aging, Response Inhibition, Alzheimer's Disease

Functional recruitment, particularly in the frontal lobes is common during aging and in those with elevated risk for Alzheimer's disease (AD). As such, frontal lobe-mediated tasks, such as response inhibition, evoke some of the earliest evidence of cognitive aging and AD risk. This study utilized electroencephalography (EEG) recorded during a response inhibition task (i.e., stop-signal) in 36 young and 44 cognitively intact, genotyped older adults. The aim was to discern the relationship between age and genetic risk for AD via the Apolipoprotein E e4 allele on frontal EEG beta-band power, which is a potential neural signature of response inhibition. Time-frequency analyses (via Fast Fourier Transform) were performed to obtain beta-band power during correct stop trials (accuracy was comparable between groups). Older adults exhibited bilaterally elevated frontal beta power (F3/F4) compared to young adults, reflecting compensation for declining neural efficiency. Within older adults, e4-carriers (e4+, n = 21) displayed even greater right frontal (F4) beta power compared to non-carriers (n=4), which interacted with age. Thus, older adults, regardless of carrier status, employ compensation; however, older adults at increased risk for AD (e4+) must employ additional compensatory mechanisms to successfully engage inhibitory control mechanisms and preserve cognitive functioning. Therefore, response inhibition-related beta band activity may be a useful prodromal marker of future cognitive decline in cognitively intact individuals, particularly in the context of AD risk and older age.

CHANGES IN ELECTROPHYSIOLOGICAL MARKERS OF VISUOSPATIAL ATTENTION AND VISUAL WORKING MEMORY WITH AGING

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Descriptors: Attention, Cortical Sources, Memory

Normal, non-pathological aging is accompanied by a decrease in short-term memory and attentional capacities and different cortical activation patterns. However, most of the studies do not control for physiological changes that also occur naturally with aging. Our goal was to examine perceptual, attentional, and memory processing using amplitude and latency of electrophysiological components (P1, N1, N2pc, and P3) and cortical sources in an aging population (N = 32, aged between 60 and 84 years old) compared to younger individuals (N = 25 aged between 24 and 30 years old) while controlling different potentially confounding variables associated with age-related physiological changes (motor slowing, change in the opacity of the cornea, and alteration in luminance perception). Flicker photometry was used to adjust the luminance of the stimuli across younger and older subjects, and a multiple frame procedure was used to prevent motor contamination. Results revealed equivalent amplitude and latency for the early components (P1 and N1), an increase in the latency of N2pc and P3, and a decrease in the amplitude of N2pc. In addition, source analyzes show that elderly subjects recruit more frontal areas than young people during the time course of P3 (already observed in the literature). Our results suggest weakened and/or slower neuronal responses mediating attention and memory confined to the central nervous system.

Funding: Centre de recherche de l’Institut universitaire de gériatrie de Montréal.
DIFFERENTIAL WITHIN-TASK CHANGE OF INFREQUENT GO AND INFREQUENT NO-GO P300 AMPLITUDE IN ADOLESCENTS

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Descriptors: P300, Go/no-go, Multilevel Modeling
The P300 event-related potential (ERP) is thought to reflect cognitive processes that include attentional allocation and context updating. As various P300s have shown cross-sectional and prospective relations with psychopathology, tasks such as the go/no-go (GNG) are increasingly leveraged to understand individual differences. In the GNG task, both infrequent targets and no-go stimuli potentiate the P300. Past work has generally assessed averaged P300 responses, rather than examining within-task change in P300. The average P300 could blur differences in habituation and continued inhibitory control over the course of the task. The current study examined trial-level trajectories of P300 amplitude by stimulus type (frequent go, infrequent go, infrequent no-go) during a modified GNG task among 73 adolescents. The largest P300s were found on infrequent no-go trials, followed by infrequent go, and then frequent go trials, indicating P300 amplitude is sensitive to both stimulus frequency and the need for inhibitory control. Using multilevel modeling, findings indicated that the amplitude of the P300 reduced across the task (i.e., negative slopes) for both frequent go and infrequent go trials; there was no linear change in infrequent no-go P300, suggesting a stable P300 from the start to end of the task when inhibitory control was required. The current findings suggest specific differences in the P300, in terms of within-task changes, between infrequent and no-go trials, which may have implications for use as an individual differences measure in future research.

A MULTIMODAL EXAMINATION OF FEATURE-BASED ATTENTION ALONG THE VISUAL HIERARCHY

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Descriptors: Multimodal Imaging, Feature-based Attention
Human and animal models alike have demonstrated effects of feature-based attention in the visual cortex. Feature dependent tissue-specific effects have been shown in various regions along the visual hierarchy, e.g., area MT+ for visual motion. Findings are less consistent with respect to the involvement of primary visual areas in feature-based attention and may depend on the imaging modality examined. In the present study, we leverage multimodal ssVEP-MRI recordings and a multidimensional (color, shape) feature-based attention paradigm to examine the two alternative hypotheses stating that feature-based effects of visual attention on ssVEPs either (1) always involve changes in V1, regardless of the feature dimension manipulated, or (2) selectively involves the visual tissue most sensitive to the feature dimension. Unimodal (MRI-BOLD) results demonstrate expected effects within regions of the dorsoparietal attention network. Ongoing multimodal analyses suggest involvement of primary visual areas in at least some forms of feature-based attention.

PATIENCE IS A VIRTUE: INDIVIDUAL DIFFERENCES IN CUE-EVOKED PUPIL RESPONSES UNDER TEMPORAL CERTAINTY

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Montana State University

Descriptors: Attention, Pupilometry, Mind Wandering
We investigated participants’ ability to engage versus relax attentional control in anticipation of hard (antisaccade) versus easy (prosaccade) trials within a saccade task, creating a “Cue-Evoked” Pupillary Response (CEP). Participants completed the OSPAN as a measure of working memory capacity (WMC) followed by a saccade task with a constant 5,000 ms delay between cue and stimulus. Occasional thought-probes were included to gauge on- versus off-task attentional state. Consistent with recent findings (Hutchison et al., 2020; Wang et al., 2015), we found greater overall performance in the Task-Related Thoughts (TUTs) on prosaccade trials, larger pupil diameters when preparing for antisaccade trials, and larger pupil diameters when on task. Further, lower WMC individuals showed pupil dilation throughout the fixation delay for both types of trials, whereas higher WMC individuals only showed dilation immediately before stimulus onset when expecting an antisaccade trial. Accuracy was predicted by WMC, smaller initial CEP, larger late CEP, and less phasic pupil variability, but not self-reported TUTs. At the latent level, although the two measures were correlated, pupil variability significantly predicted saccade accuracy whereas TUTs did not. These results both replicate and extend previous findings, demonstrating that higher WMC individuals may be more efficient at exerting control. Further, they indicate that physiological measures can provide a more valid index of attentional state than self-report measures.

PSYCHOMETRIC PROPERTIES OF PSYCHOPHYSIOLOGICAL AND BEHAVIORAL COGNITIVE DEMAND MEASURES IN APPLIED DRIVING RESEARCH

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Descriptors: Driving Research, Aging, Applied Cognition
Real-world tasks (such as driving on actual highways) are more uncontrollable and demanding than traditional lab tasks. However, there have been few empirical investigations into the stability of cognitive demand measures in real-world contexts. Applied driving research utilizes four commonly studied measures of cognitive demand: (1) heart rate, (2) heart rate variability via the root mean square of successive differences in normal heartbeats (RMSSD), (3) electroencephalogram (EEG) alpha power, and (4) reaction time from the Detection Response Task (DRT, a behavioral performance task). In the current study, we examined the reliability of these measures across multiple assessments in real-world driving settings. 39 younger participants (18–42 years old, M = 28.82 years) and 32 older participants (43–64 years old, M = 52.72 years) drove on real highways for about 18 min on four different occasions while their heart rate, RMSSD, EEG alpha power, and DRT reaction time data were collected. High test-retest reliabilities were found across measures for younger (Cronbach’s alpha: 0.857 to 0.949) and older (Cronbach’s alpha: 0.944 to 0.996) drivers, suggesting that these measures can be successfully measured in applied driving research. Despite the high reliability of each measure, we observed low correlations between each measure, suggesting that they tap into different aspects of cognitive demand during driving. The findings highlight the importance of utilizing a combination of psychophysiological and behavioral methods to capture multi-faceted cognitive demand in applied settings.

Funding: Support for this work was provided by a grant from AAA Foundation for Traffic Safety.
PUPIL DILATION TO DIRECT GAZE PREDICTS OVER-ESTIMATION OF EXPECTED BEHAVIOURAL VALUE DURING EYE CONTACT

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Descriptors: Eye Contact, Reward, Pupil

Recent studies have shown that physiological responses are enhanced during making eye contact (looking to other’s direct gaze), suggesting that eye contact may induce expectations of later rewarding events. Here, we examined how eye contact affects expected reward value using the reinforcement learning paradigm. Forty adults were recruited and conducted pupil size measures and a two-armed bandit task. In the pupil size measures, participants watched a female showing either direct gaze (DG condition) or closed eyes (CE condition) for 5 s. After that, the two-armed bandit task was conducted with 70% and 30% of reward probabilities for each option. During the two-armed bandit task, a female showing direct gaze or closed eyes was presented from the start of each trial. Results showed that behavioural bias to choices with 70% reward probability was increased in DG condition than CE condition. In the DG condition, the behavioural probability of choices with 70% reward reached about 80%, which was significantly higher than the expected reward value (70%). Also, this behavioural bias to choices with 70% reward in DG condition was predicted by pupil dilation to direct gaze. These results suggest that participants over evaluated the expected reward value in DG condition and this DG effect may be related to subjective expectations of rewarding events indexed by pupil dilations. Physiological responses to DG may reflect reward/affec-
tive processing and be able to predict behavioural bias during eye contact.

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MUSICAL TEMPO AFFECTS EEG SPECTRAL DYNAMICS DURING TIME ESTIMATION

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Descriptors: EEG Dynamics, Time Estimation, Music

Time perception depends on the rhythmicity of internal and external synchronizers. An external synchronizer that affects time perception is music. Listening to music at different tempi modify the EEG activity and may affect the functional organization during time estimation. In this study, we aimed to observe the effects of musical tempi on EEG spectral dynamics during time estimation. Twenty-eight participants performed a time production task in silence and after listening to music at different tempi, 90-, 120-, and 150-bpm, while EEG was recorded. During listening to music, there was a gradual power increase of fast rhythms, beta and gamma, as music sped up, together with an increase in alpha power in all tempi with respect to baseline. These prior functional changes affected the later time production performance, in such a way that the 90- and 120-bpm musical tempi induced a more accurate time estimation, in addition to lower alpha activity in frontal regions at the final stages of time production compared to the silence and 150-bpm conditions. Music played at 150-bpm evoked a brief initial enhancement of frontal beta rhythm compared to silence. Listening to music at 90- and 120-bpm tempi may have facilitated the temporal organization of attention, while faster music could have induced an overactivated state that interfered with cognitive control required in this task. These results suggest that prior music listening modifies the tonic EEG activity, that consequently affect the phasic activation during a time production task.

BASELINE MATTERS: DIFFERENT RESULTS WITH SUBTRACTIVE VERSUS DIVISIVE BASELINE PROCEDURES FOR TIME-FREQUENCY ANALYSES

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Descriptors: Time-frequency Analysis, Baseline Correction, Electroencephalography (EEG)

Analysis of electrophysiological data in the time-frequency domain is an increasingly popular technique. However, users must define many parameters along the analysis pipeline and make non-trivial decisions about specific methods to implement. One such decision is the method of baseline correction. Recently, we have shown in simulations that divisive baselining can introduce significant, but spurious, effects when comparing conditions that differ in the level of background activity (1/f; broadband) during the baseline period. A subtractive baseline, instead, mitigates these spurious effects. Here we compared subtractive and divisive baseline procedures on time-frequency maps derived from Morlet wavelet convolution in an EEG auditory oddball study (n = 23) conducted with eyes open or closed. We find that subtractive baselining reduced the effect of closed/open eyes on theta activity in the time-frequency maps, observable with divisive baselining, whereas the closed/open eyes effect on ongoing alpha was equally represented using both methods. We attribute this finding to the confounding effect of 1/f, which tends to produce inflated estimates for theta (which has almost no power at baseline) than for alpha (which is strongly present at baseline). This highlights the non-trivial choice of baseline procedure. Choosing which method to use requires caution as it may change the interpretation of the same data, particularly for activity not observable at baseline, such as theta, but less so for sustained oscillations, such as alpha.

Funding: NIA grant RFAAG062666 (G. Gratton & M. Fabiani, PIs).
TEST-RETEST RELIABILITY OF THE LATE-POSITIVE POTENTIAL AND THE REWARD POSITIVITY IN NEW MOTHERS
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Descriptors: LPP, RewP, Reliability
The Late Positive Potential (LPP) and the Reward Positivity (RewP) have been previously linked to psychological outcomes, such as depression. However, these two ERPPs have generally not been studied in a single sample, and it is unclear if the LPP and the RewP are reliable across time. The current study aimed to examine test-retest reliability of the LPP and the RewP in a naturalistic sample of new mothers over a span of one year, as part of a larger infant developmental study. A sample of 16 new mothers participated in a picture viewing task (n = 11) consisting of neutral, pleasant, and unpleasant stimuli to assess the LPP, and a simple gambling task (n = 16) with win versus loss outcomes to assess the RewP while electroencephalogram was recorded. Test-retest reliability was calculated using Spearman correlations across two assessment points. The LPP demonstrated a low reliability for the pleasant, rs(11) = .30, p = .370, and the unpleasant stimuli, rs(11) = -.518, p = .002, from Time 1 to Time 2 compared to the neutral stimuli, rs(11) = .68, p = .021. The RewP also demonstrated a lower reliability for win, rs(16) = .312, p = .240, than loss outcomes, rs(16) = .50, p = .047, over a one year period. Results suggest the LPP is less stable over time and may be state-dependent for emotionally valenced stimuli, while the RewP may be more stable and more trait-like for neutral stimuli. Similarly, the RewP appears to be more stable for losses compared to wins in new mothers over the span of a year.

EARLY VEP REFLECTS THE TEMPORAL-ATTENTION-MEDIATED VISUAL AWARENESS
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Descriptors: ERP, N60, Backward Masking
Elucidation of neural mechanism relevant to emergence of visual awareness is one of the important issues in visual neuroscience. The spatial attention-mediated enhancements of N1/N2 at the latency of around 130–300 ms were postulated to be the earliest electrophysiological correlate of consciousness (Koivisto et al., 2009). On the other hand, in our previous study, temporal attention-mediated augmentation of N60 (a VEP at a latency of around 60 ms following the target’s onset) was relevant to the facilitation of the subliminal affective priming. However, in this previous study, it remained to be clarified whether the N60’s augmentation was related to visual awareness for the subliminal primer. Here we modified our previous experimental paradigm and tested a hypothesis that the temporal attention-mediated augmentation of N60 (an earlier VEP component than N1/N2) would reflect enhancements of the visual awareness for the target.

In our experiments, a backward masking paradigm was used; the target (happy or fearful face) was presented for 20 ms and was followed by a mask (neutral face). To control temporal attention, a visual cue indicating the timing of the target’s presentation was presented at the beginning of each trial. Inter-individual analyses for the fearful target, to which the temporal attention was allocated, showed a significant positive correlation between enhanced visual awareness and N60’s enhancement. This finding suggests that the visual awareness enhanced by temporal attention is reflected in the early VEP at about 60 ms after the target’s onset.
LNPP AND PROBE-P3 MODULATION ASSOCIATED WITH PAST EXPERIENCE OF ASSAULT

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Descriptors: Trauma, Affect, Attention
In trauma-exposed populations, there is divergent evidence for hyper- vs. hypo-reactivity to emotional stimuli, and it is unclear how trauma-related differences in affective-attentional engagement vary with the valence (pleasantness) of stimuli. Investigating how emotional-attentional processing patterns unfold over time may help resolve divergent findings. This study examined differences in late positive potential (LPP) and probe-P3 amplitudes between adults with (N = 109) vs. without (N = 379) past experience of assault (physical, sexual, and/or with a weapon). Participants viewed pleasant, unpleasant, and neutral images for 6s each to elicit an LPP, and a noise probe occurred 3, 4, or 5s into each image interval to elicit a probe-P3 response. Participants with assault histories exhibited reduced LPP and probe-P3 amplitudes. Unlike some prior research, affective valence did not moderate these effects. The LPP reduction associated with past experience of assault was more pronounced for the early LPP (350–550 ms) compared to the late LPP (600–1,000 ms). LPP results suggest that participants with experience of assault are initially hypo-reactive to images regardless of affective valence, though this relative reduction may decrease over time. The finding of reduced probe-P3 amplitude, indicative of enhanced attentional engagement to images, suggests a dynamic temporal course of emotional-attentional capture in participants with assault histories. Previously mixed findings may be attributable to opposing effects at different stages of affective-attentional processing.

Funding: This work was supported by grant W911NF-14-1-0018 from the US Army (CJP) and grant F31MH122096 from the National Institute of Mental Health (ERP).

AN EVENT-RELATED POTENTIAL INVESTIGATION OF DISTANCED SELF-TALK: REPLICATION AND COMPARISON TO DETACHED REAPPRAISAL

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Descriptors: Emotion Regulation, Late Positive Potential, Stimulus Preceding Negativity
Emotion regulation strategies are important for managing negative emotions. However, despite their effectiveness, many emotion regulation strategies require significant cognitive resources to implement—especially during highly stressful situations and in individuals struggling with chronic levels of negative emotions. Therefore, less cognitively taxing emotion regulation strategies may need to be identified. Recent research using self-report and event-related potentials (ERPs) has shown that distanced self-talk reduces negative emotional reactivity without recruiting increased cognitive resources. Given these promising findings, this present study aimed to directly replicate this work and extend it by comparing distanced self-talk to detached reappraisal, a commonly studied emotion regulation technique. Sixty-seven participants were randomly assigned to an emotion regulation picture-viewing task and instructed to reflect on their feelings while viewing negative pictures using distanced self-talk or detached reappraisal. Directly replicating previous findings, the distanced self-talk group exhibited a reduction in the late positive potential (LPP), a neurophysiological index of affective arousal, without an increase in the stimulus preceding negativity (SPN), a neurophysiological index of cognitive control. Surprisingly, the reappraisal group did not exhibit a reduction of the LPP nor any significant modulation of the SPN. These results bolster support for distanced self-talk as a relatively effortless emotion regulation strategy.

ADOLESCENT PHYSIOLOGICAL AND SELF-REPORTED EMOTION REGULATION DIFFICULTIES: HEART RATE VARIABILITY AND SELF-REPORTED EMOTION REGULATION DIFFICULTIES DIFFER BY GENDER AND DEPRESSIVE SYMPTOM SEVERITY

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1University of Maine, 2McLean Hospital/Harvard Medical School

Descriptors: High-frequency Heart-rate Variability, Emotion Regulation, Depression
The Neurovisceral Integration Model posits that vagally mediated heart rate variability (HRV) is an objective, physiological index of inhibitory control, a key mechanism for emotion regulation (ER). Few studies have evaluated links between HRV and perceived ER difficulties, however. Williams et al. (2015) found significant associations between resting HRV and self-reported ER difficulties in adults, but this relation has yet to be examined in adolescents. Given that ER skills improve substantially across the adolescent years, better understanding the link between physiological and perceived ER abilities during this period could inform how to foster optimal ER development. A sample of 122 adolescents (ages 13–17, M = 15.49) completed self-report assessments of ER difficulties and depressive symptoms. Resting high-frequency HRV (HF-HRV) was then calculated from a 7-min ECG recording period. HF-HRV was not significantly associated with self-reported ER difficulties in the whole sample. Follow-up analyses found that higher baseline HF-HRV was significantly associated with higher impulse control difficulties for females and adolescents with more severe depressive symptoms. Results suggest females and those with greater depressive symptoms may perceive themselves as having ER difficulties (viz., with impulse control), even when they experience more adaptive physiological regulation. Adolescents’ perceptions of their ER capabilities largely differed from their physiological regulation, suggesting that providing feedback on actual regulatory abilities may be beneficial to youth.

Funding: Society for Psychophysiologial Research Training Fellowship awarded to Dr. Hannah Lawrence.
INDUCED SADNESS AND THE REWARD POSITIVITY
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University of New Mexico

Descriptors: Reward Positivity, Mood
The Reward Positivity (RewP) is a feedback-locked ERP elicited by rewarding feedback, suggesting that it may mechanistically contribute to anhedonia. Mood manipulation procedures thus provide a chance to induce clinically-relevant effects. Two studies were specifically designed to test whether sad mood induction in healthy controls could diminish the RewP relative to either a neutral condition (Study 1) or a happy manipulation (Study 2). Study one (N = 50) utilized previously established procedures before and during a Probabilistic Selection Task. There was no significant change in sadness ratings (p = .541) nor RewP amplitude (250–400 ms, P = .223, d = .349), though a significant difference was found in an early (< P2) time range (180–250 ms, p = .024). Since the lack of self-reported sadness suggests that standard methods are inadequate, study 2 (N = 50) used newly developed sadness manipulations. Sadness ratings were indeed diminished (p < .001), and although no significant difference was found in the RewP (p = .641), there was again a main effect detected in this early time range (p = .046, R² = .068). Furthermore, within the Sad group, the P2 (collapsed across feedback; r = 0.431; p = .025) can significantly predict NoGo learning (R² = 0.234, p = .020) when sadness ratings are held constant; this model could not significantly predict Go learning. These results suggest that mood manipulation procedures may not directly affect reward-related processing, but rather generally boost salience which in turn may affect punishment-related learning.

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THE REWARD POSITIVITY IS ENHANCED IN INDIVIDUALS WITH ALCOHOL USE DISORDER
Garima Singh1, Ethan Campbell1, Jeremy Hogeveen1, Katie Witkiewitz2, Eric Claus1,2, and James Cavanagh1
1University of New Mexico, 2The Mind Research Network

Descriptors: Reward Positivity, AUD, Affective Imagery
The Reward Positivity (RewP) is a positive deflection in the EEG following reward receipt. Recent evidence suggests that the RewP is modulated by both reward probability as well as subjective rating of liking. Here we examined the sensitivity of the RewP to positive affective and alcohol images in individuals with alcohol use disorder (AUD). We recruited 49 participants (AUD = 27, Control = 22). Participants completed both a standard 2-doors task with point feedback (green +1 or red −1) as well as a reinforcement learning task with picture feedback (puppy or alcohol images over a green or red screen). The AUD group had an enhanced RewP to point feedback in the 2-doors task (F(1, 48) = 21.78, p < .001), as well as a main effect of larger RewP to all valanced picture feedback (F(1, 48) = 29.2, p < .005), yet there was no difference between puppy or alcohol images (F(1, 48) = 3.88, p = .88). Across all participants, there was a positive correlation between image “liking” ratings and RewP amplitudes (r = 0.321, p < .05), replicating prior findings of an affective influence on the size of the RewP. These findings indicate that individuals with AUD have a larger RewP at baseline and suggests a domain-general enhancement of reward responsiveness in the AUD group while any modulation of this signal by alcohol-specific cues is in line with general “liking” related trends observed in control samples.

Funding: This Research has been funded by Grand Challenge Award to Dr. James F. Cavanagh.

LONGITUDINAL STABILITY OF THE EPN AND LPP DURING EMOTIONAL SCENE PROCESSING IN INDIVIDUALS WITH PSYCHOSIS
Rebekah Trotti1, Dean Sabatinelli1, Jennifer McDowell2, Godfrey Pearlson3, Matcheri Keshavan1, Sarah Keedy4, Elliot Gershon4, Elena Ileva5, Carol Tammenga6, and Brett Clementz7
1University of Georgia, 2Yale School of Medicine, 3Harvard Medical School, 4University of Chicago, 5University of Texas Southwestern Medical Center

Descriptors: Emotional Scene Processing, Psychosis, Longitudinal Stability
The EPN and LPP are two well-studied indices of emotional scene processing. These EEG components are potential biomarkers of cognition-related emotional deficits in psychosis. Previous research demonstrates the EPN and LPP are stable over repeated stimulus presentations within one session, but their long-term stability has not been evaluated in psychosis. Here, we test their longitudinal stability over a year in people with psychosis. Sixty individuals with psychosis and 14 healthy comparisons (HC) viewed pleasant (P), neutral (N), and unpleasant (UP) scenes while EEG data were recorded. This procedure was repeated using the UP2 and 12 months later. The EPN (150–250 ms) was quantified using 6 occipitotemporal sensors and the LPP (400–900 ms) was quantified using 5 centroparietal sensors. Intraclass correlations (ICC) were conducted to evaluate the stability of components across time points. Both the EPN and LPP had overall ICCs of .71. ICCs were higher in HC (EPN = .89, LPP = .85) than in psychosis (EPN = .67, LPP = .67). Responses to N scenes (EPN = .60, LPP = .60) were less stable than responses to P (EPN = .76, LPP = .72) and UP (EPN = .68, LPP = .68). Results indicate the EPN and LPP are largely stable biomarkers of emotional scene processing. Stability was excellent in HC for all scene types and fair to good in psychosis. Follow-up studies should test if lower stability is related to symptom changes. Stability was highest for emotional stimuli in both groups, indicating these components index automatic emotional processing that is not significantly affected by stimulus familiarity.

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GENDER MODERATES THE ASSOCIATION BETWEEN GREATER N2 ACTIVATION AND INCREASED ANXIETY: AN ERP STUDY
Morgan Middlebrooks, Arooj Abid, Connor Logan, and Connie Lamm
University of Arkansas

Descriptors: ERP, Gender, Anxiety
Anxiety disorders are prolific, with the National Institute for Mental Health (2018) estimating a lifetime prevalence rate of up to 31.1% across adults in the U.S. Though a considerable amount of research has been conducted linking cognitive control and anxiety symptoms, minimal research has investigated the impact of gender on this relationship. We explored if gender might moderate the association between anxiety and cognitive control in a large sample of college students. We measured N2 activation, an ERP associated with various aspects of cognitive control, while participants played a go/nogo task. We conducted a regression model and found that increased anxiety was associated with more negative N2s, at the level of a trend, b = −.49, t = −1.90, p = .06. We did not find a main effect of gender, b = −.03, t = −.38, p = .71. Interestingly, we found an interaction between anxiety and gender, b = −.59, t = −2.28, p = .02. Follow-up analyses revealed a significant of anxiety symptoms on N2 activation for men (b = −.49, t = −1.15, p < .001) but not for women (b = −.14, t = −1.24, p = .22). These results suggest that high anxious males showed more negative N2 amplitudes than low anxious males, which suggests a need for a better understanding of the impact of gender when analyzing ERP activation.
INDIVIDUAL DIFFERENCES IN SENSITIVITY TO ALCOHOL MODERATE ALCOHOL CUE-ACTIVATED APPROACH TENDENCY AND ITS NEUROCOGNITIVE CORRELATES

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Descriptors: Alcohol, Motivation, Conflict
Low sensitivity (LS) to alcohol is a trait-like risk factor for alcohol use disorder (AUD) proposed to also mark a propensity to attribute excessive appetitive value to alcohol cues, imbuing them with the ability to activate behavioral approach and thereby promote drinking. In the current study, we aimed to test whether individual differences in alcohol sensitivity moderate cue-elicited approach and its neurocognitive correlates. A sample of 178 healthy emerging adults (18–20 years) stratified to span the continuum of sensitivity to alcohol completed a joystick-based approach-avoidance picture viewing task while the electroencephalogram was recorded. We then isolated the P3 and N450, event-related potential components that index stimulus significance and response conflict, respectively. We found that as alcohol sensitivity decreased, approach responses (joystick push) to alcohol cues became significantly faster than avoid responses (joystick pull) to alcohol cues. Thus, LS drinkers exhibited enhanced stimulus significance when approaching alcohol cues and amplified response conflict when avoiding them. These findings support a link between individual differences in sensitivity to alcohol and attribution of appetitive value to alcohol cues.

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HEART RATE VARIABILITY AS A CORRELATE OF WORKING MEMORY CAPACITY

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Montana State University

Descriptors: Working Memory Capacity, Heart Rate Variability
Heart rate variability (HRV) refers to the changes in time between successive heartbeats and is thought to reflect the heart’s ability to adapt and respond to varying circumstances by detecting and responding to unpredictable stimuli (Acharya et al., 2016). Although greater resting baseline vagally-mediated HRV has been shown to be associated with better cognitive task performance (Forte et al., 2019; Hansen et al., 2003; Johnsen et al., 2003), no one has directly examined whether individuals higher in working memory capacity (WMC) have greater resting baseline HRV. Physiological measurements (heart rate and respiration) were collected with electrocardiograph (ECG) electrodes and BioNomaxid receivers which transmitted signals to a Biopac MP-150 system. The HRV index used in this study was calculated from the inter-beat intervals and inter-breath intervals data extracted from the ECG and respiration signals. After electrode placement, participants first underwent a resting baseline period and then completed the shortened Automated Operation and Symmetry Span tasks as a measure of WMC. HRV during a five-minute resting baseline period significantly and positively correlated with WMC. These results indicate that individuals higher in WMC have greater resting baseline vagally-mediated HRV.

Funding: Social Sciences and Humanities Research Council (SSHRC) Canada Joseph-Armand Bombardier Doctoral Scholarship; American Psychological Association (APA) Division 38 Graduate Student Research in General Health Psychology Award; University of British Columbia Arts Graduate Student Research Award; Natural Sciences and Engineering Research Council (NSERC) Canada Discovery Grant.

THREAT MODULATION OF THE ERN AND DISPOSITIONAL THREAT SENSITIVITY

Keenan Roberts, Kelsey Lowman, Keanan Joyner, Emily Perkins, and Christopher Patrick
Florida State University

Descriptors: Error-related Negativity, Threat Sensitivity
The Research Domain Criteria initiative emphasizes multi-modal, transdiagnostic research on psychopathology. The cortical error-related negativity (ERN) has been shown to be enhanced in individuals with certain anxiety disorders. Prior work has also demonstrated differential magnitudes of event-related potentials (ERPs), including the ERN, under conditions of threat versus safety. The current study investigated a transdiagnostic anxiety-relevant trait, dispositional threat sensitivity, in relation to ERN under threat. We examined (1) the effectiveness of a task-switching paradigm for eliciting the ERN in an undergraduate sample (N = 92); (2) the effect of potential threat (unpredictable electric shock) on this brain response; and (3) the moderating role of dispositional threat sensitivity on the impact of shock-threat on the ERN. As hypothesized, a robust ERN was observed, and a repeated-measures ANOVA showed that the ERN was potentiated during blocks that included unpredictable shocks. However, dispositional threat sensitivity was not associated with ERN and did not moderate the threat-context effect. The relative increase in ERN magnitude under threat conditions suggests that errors are more salient when aversive stimuli are present in the environment (Hajcak, 2012). Contrary to hypotheses, this effect was observed irrespective of individual differences in self-reported threat sensitivity, suggesting that the association between the ERN and anxiety-related problems may reflect a process distinct from dispositional threat sensitivity (e.g., rumination; error sensitivity).

HIGH-FREQUENCY HEART RATE VARIABILITY REACTIVITY AS A STABLE INDIVIDUAL DIFFERENCE ACROSS DISTINCT COGNITIVE AND EMOTIONAL DEMANDS

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University of British Columbia

Descriptors: Heart Rate Variability Reactivity, Environmental Demand, Health
High-frequency heart rate variability (HF-HRV) is a marker of cardiovascular health and an index of the parasympathetic nervous system’s ability to adaptively respond to environmental demands. In prior research, maladaptive HF-HRV reactivity to cognitive challenge and to negative emotion states has been associated with adverse health outcomes and poorer emotional functioning. In the current study, we examine the relationship between HF-HRV reactivity to cognitive challenge and HF-HRV reactivity to a negative emotional state, to establish the extent to which parasympathetic responding may reflect stable individual differences in adaptability to differing demands. Under controlled laboratory conditions, HF-HRV reactivity to a challenging cognitive task and HF-HRV reactivity to a negative emotional induction were assessed in a sample of 448 healthy university students (287 female, mean age = 20.09 years). As expected, HF-HRV reactivity to cognitive challenge was strongly and positively associated with HF-HRV reactivity to negative emotion, even after controlling for demographic, health, and psychosocial covariates. These findings provide evidence for individual differences in parasympathetic adaptability that remain stable across distinct cognitive and emotional demands, with implications for physical health and emotional wellbeing.

Funding: Social Sciences and Humanities Research Council (SSHRC) Canada Joseph-Armand Bombardier Doctoral Scholarship; American Psychological Association (APA) Division 38 Graduate Student Research in General Health Psychology Award; University of British Columbia Arts Graduate Student Research Award; Natural Sciences and Engineering Research Council (NSERC) Canada Discovery Grant.
LEFT DORSAL ANTERIOR INSULA CORtical THICKNESS INVERSELY ASSOCIATED WITH SUBJECTIVE STRESS-HEART RATE COHERENCE

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University of Wisconsin, Madison

Descriptors: Coherence, Stress, Brain Imaging
What brain structures contribute to greater coherence between peripheral physiological signals and subjective mental states? Extant evidence suggests the anterior insula plays a key role in integrating the physiological state of the body and subjective experience. Frequently co-activated with the insula, the anterior cingulate cortex has been implicated in interoception and emotion awareness. We predicted that greater cortical thickness in these regions would be associated with stronger coherence between subjective experience and physiological activity. In a sample of N = 82 participants from the Midlife in the United States study (MIDUS; www.midas.wisc.edu), we investigated cortical thickness in the anterior insula and dorsal anterior cingulate in relation to stress-heart rate coherence, the within-individual association between subjective stress and heart rate over the course of a paradigm involving both stressful and non-stressful periods (Sommerfeldt et al., 2019). Individuals with thicker left anterior insula and stressful PCI had higher emotional distress when statistically adjusting for age and sex, b = −1.20, F(1, 45.7) = 4.61, p = 0.037. Cortical thickness in the right anterior insula and dorsal anterior cingulate was not significantly associated with stress-heart rate coherence. Future analyses using multimodal imaging data in this sample will seek to better understand these findings. Results provide some of the first evidence of neural correlates of subjective experience-physiology coherence.

Funding: MIDUS was supported by John D. and Catherine T. MacArthur Foundation Research Network, National Institute on Aging (PO1-AG020666, UI9-AG051426), and the NIH National Center for Advancing Translational Sciences (NCATS) Clinical and Translational Science Award (CTSA) program; UL1TR001409 (Georgetown), UL1TR001881 (UCLA), IUL1RR025011 (UW). S.L. Sommerfeldt was also supported by a University of Wisconsin–Madison fellowship, a predoctoral fellowship through the Training Program in Emotion Research funded by the National Institute of Mental Health (T32MH018931-28), and a Ruth L. Kirschstein Predoctoral Individual National Research Service Award (F31AG066323).

HIGH FREQUENCY HEART RATE VARIABILITY MODERATES THE ASSOCIATION BETWEEN EMPATHY AND ATTENTION TO THREAT IN CHILDREN

Arden Cooper, Sarah Garcia, and Erin Tully
Georgia State University

Descriptors: Regulation
The primary hypothesis is to test whether empathic tendencies in school-aged children (N = 115; 48.5% female, M = 5.48 years, SD = .65) may be linked to risks for internalizing problems, specifically attention biases toward threat, in the context of poor physiological regulation. Children’s empathic tendencies were measured using two subscales, Empathic Behavior and Remorse, of the My Child parent-report behavioral rating scale. Children’s resting HF-HRV was calculated from ECGs collected while children viewed a neutral and stressful PCI video. An emotional dot probe paradigm was used to index children’s attention to angry faces. Interactions were significant between HF-HRV and both empathic behavior (B = .31, p < .01) and remorse (B = −.24, p < .05) predicting attention bias to angry faces. At high levels of HF-HRV (i.e., 1 SD above the mean, indicating good regulation), children with high levels of empathic behavior (B = .80, p < .05) and children with high levels of remorse (B = .68, p < .01) had significantly higher attention bias towards angry faces. At low levels of HF-HRV (i.e., 1 SD below the mean; poor regulation), children with high levels of empathic behaviors (B = −.72, p < .01) and children with high levels of remorse (B = −.47, p < .10) showed greater attentional avoidance of angry faces, though the association for remorse was not significant at alpha = .05. Highly empathic children with poor emotion regulation capacity may be prone to personal distress and may avoid others’ anger, while children with good emotion regulation may express sympathy and attend to others’ anger.

Funding: Cleon C. Arrington Research Initiation Grant from the Georgia State University Research and Services Administration awarded to Erin Tully.

INFANT PARASYMPATHETIC ACTIVITY PREDICTS CHILDHOOD EMOTION DISREGULATION

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Virginia Tech

Descriptors: Respiratory Sinus Arrhythmia, Emotion Regulation, Parent Child Interaction
Polyvagal theory (PVT) posits an adaptive response strategy to allocate physiological resources during stressors, such that a decrease in parasympathetic activity allows the body to respond appropriately to distress. In previous work, low resting respiratory sinus arrhythmia (RSA) and restricted vagal withdrawal (reactive RSA) during a stressful task have been associated with emotional dysregulation (ED). However, longitudinal observations from infancy to toddlerhood are limited, and the relationship of RSA to later ED during a stressful parent-child interaction (PCI) is unclear. The current study examined prospective associations of early RSA (at 5-months old; mean) and later ED measured via frustration levels during a PCI puzzle task at 24-mo in 237 healthy children. We hypothesized that low resting RSA and restricted vagal withdrawal at 5-mo would relate to high ED at 24-mo. Infant RSA was collected during a baseline task and two stressful PCI tasks and calculated as the natural-logged spectral power value of the high-frequency bandwidth; reactive RSA was computed as task minus resting RSA. Separate linear regressions indicated that low resting RSA (beta = −.15, p = .044) and positive reactive RSA (i.e., vagal augmentation; beta = .15, p = .038) significantly predicted high levels of 24-mo frustration during a stressful PCI, after accounting for crying. In sum, infants with low resting RSA and vagal augmentation demonstrated difficulty with their emotion regulation as toddlers, indicating an RSA response that is only partially consistent with PVT.

RELATIONSHIPS BETWEEN COGNITION, REWARD DRIVE, AND IMPULSIVITY IN ADOLESCENCE AND YOUNG ADULTHOOD

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University of Newcastle, University of Utah, Neuroscience Research Australia (NeuRA)

Descriptors: Cognitive Control, Reward-drive, Impulsivity
Adolescence is a period of significant physical, social, and psychological development. It is also a time when engagement in risky behaviours is increased. This is thought to be because the subcortical areas of the brain involved in reward drive and emotion are fully developed, while the frontal areas of the brain involved behaviour regulation are still developing. This means that adolescents are more to make decisions that will result in the biggest reward, without thinking through the consequences of that decision. However, these theories do not account for individual differences among young people. The present study examined individual differences in cognition, reward drive and impulsivity in adolescents and young adults (N = 75). Participants completed 2 phases of testing 2–4 years apart where they completed self-report and performance-based measures of cognition, reward drive and impulsivity. Linear mixed effects modelling was used to examine the relationship between these measures, and how these relationships changed over time. Age effects on cognitive control, impulsivity, and reward drive were broadly consistent with previous literature, continuing to mature across adolescence into young adulthood, and plateauing thereafter. However, relationships between cognitive control, reward drive, and impulsivity were not impacted by age. These findings contribute to a growing body of evidence that suggests risky behaviour is not age specific, but rather, is the outcome of individual differences in cognition, impulsivity, and reward drive.

Funding: Australian Research Council Discovery Project, Grant/Award Number: DP12000340 and DP17000756.
ASSOCIATIONS BETWEEN INFANT NEGATIVE AFFECT, INFANT FRONTAL ALPHA ASYMMETRY, MATERNAL DEPRESSION, AND PARENTING
Lidia YX Panier, Aislinn Sandre, Clara Freeman, Iulia Banica, Viveca Lee, and Anna Weinberg
McGill University

Descriptors: Frontal Alpha Asymmetry, Maternal Depression, Negative Affect

Frontal alpha asymmetry (FAA) is an established neurobiological marker of risk for depression. Greater right-than-left activity is thought to reflect an increased tendency to respond to negative stimuli and withdraw from positive stimuli. This FAA pattern has been found in women with a history of depression as well as in their infants, but not all infants of mothers with depression show this pattern of FAA, or go on to develop depression. The pathway to depression may also be influenced by how the mothers behave towards their infant, such as intrusive engagement versus sensitive responsiveness. We investigated whether maternal parenting style and the severity of different depressive symptom profiles interacted with infant resting FAA to predict infant negative affect, an early observable behavioral risk factor for depression. We collected resting FAA data in the 6-9 Hz range from 48 7-month-old infants, and coded infant affect and parenting behavior during free play. Results showed that infants of mothers with higher symptoms of lassitude had greater FAA. Additionally, infant FAA interacted with maternal parenting style to predict negative infant affect. Higher intrusiveness and lower sensitivity (in separate models) interacted with greater FAA to predict more negative affect in infants. Maternal symptoms were not significantly associated with infant affect. Findings suggest that the effect of FAA on early indices of depression vulnerability may depend on maternal parenting behaviors, over and above the effects of maternal depression severity.

INFANTS WITH DECREASED HF HRV SHOW GREATER NEGATIVE AFFECT IN RESPONSE TO AN ACUTE SOCIAL STRESSOR
Claire Brabander, Kristin Horsley, Aislinn Sandre, and Anna Weinberg
McGill University

Descriptors: Heart Rate Variability, Social Stressor, Negative Emotion
Cardiovascular reactivity to acute stress is critical for social and emotional development in infancy. Infant cardiovascular responses to stress can be monitored using heart rate variability (HRV). Greater HRV in the high frequency range (HF HRV) is associated with more adaptive autonomic stress responses, whereas lower HF HRV is associated with less adaptive stress responses. However, few studies have investigated the concordance between infant emotional and cardiovascular reactivity in response to an acute social stressor. The present work aimed to examine how infant HF HRV responds to a social stressor and if infant emotional factors predict HF HRV. A sample of 44 infants (M = 6.06 months, SD = 0.33) completed a stranger approach-still face task, an acute social stressor. Infants wore a Polar H10 heart rate monitor and were video recorded throughout. HRV was derived using Kubios HRV software and infant affect was scored according to the laboratory temperament assessment battery (Lab-TAB). Results from a repeated measures ANCOVA indicated that mean log HF HRV decreased during the stranger approach relative to pre- and post-separation periods. Further, there was a significant time by negative affect quadratic interaction, such that greater infant negative affect was associated with lower HF HRV during the stranger approach. During an acute social stressor, infants who display higher levels of emotional distress also show a less adaptive cardiovascular response that, together, may augment or interfere with social and emotional development during infancy and early childhood.

GENERAL AND SPECIFIC FACTORS OF CHILDHOOD ADVERSITY AND THEIR ASSOCIATIONS WITH BRAIN STRUCTURES
Hee Jung Jeong, Tyler Moore, E. Leighton Durham, Gabrielle Reimann, Carlos Cardenas-Iniguez, Randolph Dupont, Marc Berman, Benjamin Lahey, and Antonia Kazakurkin
Vanderbilt University, University of Pennsylvania, University of Chicago

Descriptors: Early Life Adversity, Brain Structures, Bifactor Model
Multiple types of childhood adversity often co-occur. The high co-occurrence and non-specific adverse outcomes associated with childhood adversity suggest that different types of early-life stressors may increase adverse functioning through similar mechanisms, including changes in brain structures. Using a large sample of children aged 9 to 10 years from the Adolescent Brain and Cognitive Development Study, the current study aimed to identify general and specific dimensional factors of childhood adversity and their association with brain structures measured by cortical thickness and gray matter volume. A bifactor model identified a general factor that represents common variance across multiple environmental stressors and specific factors of neighborhood deprivation, familial risk, interpersonal community, and urbanicity. Using structural equation modeling and controlling for age, sex, race/ethnicity, and MRI scanner, the general factor was associated with cortical thinning in frontal, parietal, and occipital regions and globally smaller cortical and subcortical volumes. The specific factors of neighborhood deprivation and urbanicity were associated distinct deficits in cortical thickness in frontal, temporal, and parietal regions and urbanicity was additionally associated with globally larger cortical and subcortical volumes. The current study suggests environmental stressors may be important risk factors for structural aberrations in the developing brain.

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THE RELATION OF CONTEXT-SPECIFIC SEDENTARY BEHAVIOR TO ATTENTION AND RESTING-STATE EEG FRONTAL BETA ACTIVITY IN YOUTH

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Descriptors: Physical Inactivity, Adolescence, Cognition

Research in youth evaluating sedentary behavior suggests that context is positively (i.e., schoolwork, reading) and negatively (i.e., electronic gaming, watching TV) related with cognitive function. However, no research has evaluated context-specific sedentary behavior with underlying brain mechanisms that support healthy psychological development. This study aims to evaluate the relation of context-specific sedentary behavior to electroencephalography (EEG) resting-state frontal beta activity and selective attention (continuous performance task, CPT) in adolescent youth. Participants stem from a long-term longitudinal community study (RIGHT Track) who completed measures at 17-years old (n = 66; 43 females). Resting-state beta (14–20 Hz) activity recordings were obtained (16-channels) during eyes open and closed. Linear regression models were performed for CPT performance and frontal beta activity, controlling for demographic measures. CPT results revealed fewer commission errors and greater detectability (d-prime) with more hours engaged in reading/homework and schoolwork on a computer (p's ≤ .05). EEG results revealed reduced beta activity with more hours engaged in TV and electronic gaming (p's ≤ .05), and greater beta activity with more hours engaged in reading/homework and schoolwork on a computer (p's ≤ .04). These data highlight the necessity of future research evaluating relations of physical activity to brain function and cognition to account for the potential moderating effects of context-specific sedentary behavior.

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ERROR-RELATED ERPS DO NOT MEDIATE THE RELATIONSHIP BETWEEN PARENTING AND ANXIETY IN OLDER CHILDREN

Kathy Sem, Alycia Winters, Brianna Lind, and Jason Moser
Michigan State University

Descriptors: Parenting, Anxiety, Event-Related-Potentials

Recent studies show that the error-related negativity (ERN) mediates the relationship between harsh parenting and anxiety in young children. This suggests that maladaptive parenting impacts children's error processing mechanisms related to cognitive control and risk for anxiety. Our study aims to test this mediation in older children with the addition of the error-positivity (Pe), another error processing mechanism. We hypothesized that both the ERN and Pe would mediate the relationship between negative parenting and anxiety. Our sample included 146 children, ages eight to 13 (mean = 10.61; standard deviation = 1.70). Children completed the Revised Child Anxiety and Depression Scale to assess for anxiety symptoms, and reported on parenting behavior using the Parent Perception Inventory. Children also performed a go/no-go task to elicit the ERN and Pe. Predictors included positive and negative mom parenting and positive and negative dad parenting. Results showed that negative mom parenting related to a smaller late Pe (Beta = -0.23, p < .05), but indirect effects across all models were not significant. No other effects were significant. These results emphasize the need to examine the effects of parenting and error processing on risk for anxiety more broadly across development.

Funding: This data was funded by the Michigan Longitudinal Study Grant 1R01DA03911201.

BACKWARDS CONDITIONING AND INTOLERANCE OF UNCERTAINTY: AN ERP AND SCR INVESTIGATION

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Texas A&M University

Descriptors: Threat, ERP, SCR

In a therapeutic context, extinguishing contextual threat memories can be difficult, as direct exposure to the threatening context is often not possible, thus these memories must be indirectly retrieved. Unlike forward-conditioned (FW) cues, in which an unconditioned stimulus (US) follows the cue, backwards-conditioned (BW) cues are presented immediately after the US. BW cues do not become directly associated with the US, but may indirectly retrieve threat memories via activation of the conditioning context. Here, unselected participants (n = 49) completed a threat-of-shock conditioning task with BW, FW, and no-threat (N) cues. In the first half of acquisition, participants showed larger LPPs and heightened SCR to BW cues, while participants with higher intolerance of uncertainty (IU), a risk factor for internalizing psychopathology, showed increased SCR to BW cues and smaller LPPs to FW cues. In the second half of acquisition, FW cues took on increased significance, as evidenced by larger LPPs (compared to BW and N cues). Individuals with higher IU showed smaller LPPs to BW cues. Therefore, IU is associated with increased arousal to BW cues (SCR) early on during conditioning, as well as persistent reductions in the elaborated processing of BW cues (LPP), which may indicate reduced engagement with/willful avoidance of contextual cues. These findings support the use of BW cues as a means of indirectly retrieving contextual threat memories, and suggest particular significance of BW cues for individuals at risk for internalizing psychopathology.

Funding: A. MacNamara was supported by NIMH K23MH103553.

DEER IN HEADLIGHTS: MICROSACCADE INHIBITION OCCURS AS A COMPONENT OF THE HUMAN FREEZING RESPONSE

S. Roxanne Miltenberger, W. Matt Friedl, and Andreas Keil
University of Florida

Descriptors: Microsaccade, Aversive Conditioning, Freezing

Mammals have evolved a postural freezing response to threatening situations; humans and other primates exhibit more subtle freezing responses that can be assessed under certain laboratory conditions. Recent studies have reported a decrease in oculomovement when presented with naturalistic threatening stimuli. Given the large variation in naturalistic stimulus characteristics, it is unclear to what extent these findings reflect differences in physical stimulus properties. To address this gap in our knowledge, using fully controlled experimental stimuli, the current study investigated the effect of spatial aversive conditioning on small fixational eye movements called microsaccades. Fifty-one participants underwent aversive conditioning in which a Gabor patch at one of five screen locations was paired with a loud (90 dBA) blast of noise. The other four locations were never paired with the loud noise. An eye tracker (Eyelink 1000+) monitored the microsaccadic response and pupil diameter of each participant as they viewed the Gabor patches. EEG data were recorded from 129 sensors. The magnitude and frequency of fixation-related oculomotor activity were quantified using convolution with a family of Morlet wavelets. The results showed a selective decrease in microsaccadic eye movements at frequencies between 3 and 8 Hz for the aversively conditioned screen locations compared to pre-conditioning levels. This reduction in microsaccadic activity co-occurred with selective pupil dilation and suggests a brief freezing of gaze when presented with a threatening cue.
GOING AGAINST THE BRAIN: PUPIL DILATION AND ALPHA POWER DIFFERENTIALLY TRACK LEARNING UNDER UNCERTAINTY

Kierstin Riels, Dachel Sanchez, Maeve Boylan, and Andreas Keil
University of Florida

Descriptors: Gambler’s Fallacy, Rescorla-Wagner, Modeling
There is extensive debate regarding the role of attention and surprise in reinforcement learning; one view states that surprise directly modulates learning, and another states that surprise modulates attention which in turn affects learning. The Rescorla-Wagner (RW) learning rule is a theory that formalizes the first view. A separate phenomenon in reinforcement learning is the Gambler’s Fallacy (GF), which describes the negative correlation between reinforcement rate and subjective reinforcement expectancy. The present study explores this divergence in the literature by examining the roles of neural oscillations and sympathetic nervous system activity via pupil dilation over time. Single-trial alpha oscillation power and pupil response over time was studied in a classical Pavlovian conditioning procedure with one CS+, a black and white visual grating, and one US, a loud white noise burst, with a 50% chance of pairing in each of 120 trials. Before each trial participants gave upcoming US expectancy ratings. There were 35 student participants from the University of Florida. All data were fit using an RW or a GF model on a trial-by-trial basis. Preliminary results show that overall pupil size was larger after participants experienced a US, while pupil change was greater in trials of high US expectancy. Behavioral modeling revealed that rating patterns in one third of the participants followed the RW rule, while the rest followed the GF model. During time of CS+US anticipation, we hypothesize that pupil data will follow the GF model, while alpha power will follow the RW model.

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DETECTING CONCEALED INFORMATION

Nicholas Santopetro, Elizabeth Mulligan, Christopher Brush, and Greg Hajcak
Florida State University

Descriptors: ERPs, Multiple Assessment, Depression
With increasing interest in using ERPs to track course of mental health disorders and as outcomes of interventions, understanding how ERPs change following repeated assessments is critical to advance our understanding of neural mechanisms implicated in psychopathology. Moreover, it is unclear how clinical characteristics may impact ERP trajectories over repeated assessments. The present study assessed P300 amplitude from a flanker task at four time points over one month in 79 female undergraduates to determine how P300 amplitude changes over repeated assessments, whether current depressive symptoms moderates change in P300, and whether multiple P300 assessments can be used to explain more variance in depression. Utilizing multilevel modeling (MLM), there was a significant linear decrease in P300 across assessments and a significant negative relationship between anhedonia and P300, such that individuals with increased anhedonia exhibited reduced P300 across all assessments; anhedonia did not moderate change in P300 across assessments. There was no significant main effect or interaction involving current dysphoria scores, suggesting that a reduced P300 in depression may be specifically sensitive to disruptions in hedonic processing. Lastly, our model employing flanker P300 from all four assessments explained significantly more variance in anhedonia compared to a model in which only baseline (i.e., first assessment) P300 data was used, providing support for the clinical utility of repeated assessments of the flanker P300 to explain depressive symptom outcomes.

Funding: NIMH T32MH09311.
THE EYE AS A WINDOW TO THE BRAIN: CO-REGISTRATION OF PUPILLOMETRY AND EVENT-RELATED BRAIN POTENTIALS IN HUMAN COGNITION

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Descriptors: Pupillometry, Event-Related Potentials
Both pupillometry and ERPs are useful tools in cognitive psychophysiology that provide insight into neural mechanisms of behavior. Yet, few researchers have simultaneously used both methodologies within an experimental paradigm. Co-registration of EEG and pupillometry can offer useful converging evidence, such that insights gained from both methods outweigh the benefits of using either method independently. Here, we review several recent experiments from our lab in which the addition of pupilary data to ERP paradigms has clarified key uncertainties, and provided novel insights into the functional significance of both the cognitive pupil dilation response (PDR) and specific ERP components. In Experiment 1, we show that the P3b and PDR are functionally independent, but that each predicts response behavior in the oddball paradigm. In Experiment 2, we examined ERP and pupil responses to semantic and syntactic violations during sentence processing. We show that the P600 to semantic—but not syntactic—violations is associated with a robust PDR response, suggesting that these components are dissociable. In Experiment 3, we use the PDR as a proxy of effort when listening to speech-in-noise. We show that, while noise diminishes the auditory N400, when listeners respond to noise by expending additional listening effort (reflected by larger PDRs), they can recover the auditory N400 effect. Collectively, these studies show that the simultaneous recording and analysis of pupillometry and ERPs provide insights into human cognition beyond the sum of their parts.

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MODELLING THE REWARD POSITIVITY WITH A SIMULATED HALF-COSINE IN THE DELTA RANGE: IT HAS ITS UP AND DOWN

Trevor Jackson¹, Darin Brown², and James Cavanagh¹
¹University of New Mexico, ²Pitzer College

Descriptors: Reward Positivity, Modelling
The reward positivity (RewP) is a feedback-related ERP component elicited in response to reward, dominated by delta-band activity, and commonly computed via a difference wave (reward minus punishment). This computation is problematic, as these signals have independent variance. Here we report how modality (sight vs. sound) changes the latency of reward-specific activity relevant to the obligatory background ERP modulated by punishment. Five separate studies leveraged separate manipulations of reward modality and timing (visual and auditory doors tasks) to test whether an artificial half-cosine in the delta range added to punishment conditions could approximate the RewP as an additive and temporally independent ERP component. In studies one (N = 24) and two (N = 24), participants received visual feedback (rewards/punishments) or auditory feedback separately to establish that the RewP peaks earlier in auditory conditions. In studies three (N = 24) and four (N = 24), participants received combined visual and auditory feedback to establish that the auditory RewP latency is privileged in the presence of visual feedback. In study five (N = 41), participants received auditory feedback with different delays to establish that the RewP can also be pushed backwards. In all five studies, the RewP was best be characterized by fitting a half-cosine in the delta range on top of the obligatory background ERP. These findings suggest that rewards elicit an independent brain response that is not related to the punishment-sensitive obligatory background ERP, suggesting an independent spatial generator.

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MONETARY REWARD ENHANCES MOTOR INHIBITION CONTROL IN A GO/NO-GO TASK

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Descriptors: No-go N2, No-go P3, BIS/BAS Scales
Previous studies have reported that the No-go N2 and No-go P3 may reflect response conflict or response inhibition; however, it remains unclear whether they are also affected by motivational factors. We examined the impact of motivational factors and the relationship between individual differences in responsiveness to punishment/reward and these ERP components. Twenty-eight participants performed a Go/No-go task (80% Go, 20% No-go) in two conditions. In the reward condition each correct rejection for the No-go stimulus was rewarded with 10 yen (~10 cents) whereas in the neutral condition neither monetary reward nor punishment was contingent on response outcomes. Participants performed 8 blocks of 120 trials in each condition. We evaluated individual differences in responsiveness to punishment/reward using BIS/BAS scales. The error rate was significantly lower in the reward condition than in the neutral condition. P3 amplitudes for both correct rejection and partial error trials (i.e., behaviorally correct trials, but erroneous muscular activities preceding the overt response) were larger in the reward condition than in the neutral condition. No-go N2s did not differ between the two conditions. These results suggest that monetary reward might enhance motor inhibition control in the Go/No-go task. We found negative correlations between BIS scores and N2 amplitudes for both correct rejection and partial-error trials in the neutral condition. We concluded that the No-go N2 amplitude may be modulated by both reward-induced motivation and avoidance motivation.

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HUNGER IS ASSOCIATED WITH AN INCREASED NEURAL RESPONSE TO FOOD REWARD

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¹McGill University, ²Purdue University

Descriptors: Reward Positivity (RewP), Food Reward, Reward Salience
The reward positivity (RewP) is a neural index of reward sensitivity. Prior work suggests that heightened motivation to obtain reward, as well as greater reward value, are associated with an enhanced RewP. Our study sought to investigate whether the degree to which a reward is salient to an individual’s current motivational state might modulate the RewP, as well as whether the RewP might predict motivated behaviors, in a sample of 133 young adult women. To elicit the RewP, participants completed a forced-choice guessing task in which performance was rewarded by a selection of high-calorie foods. Data were collected on food-related behaviours during the task (i.e., type of food chosen, consumption of the food reward), as well as factors that may influence the motivational salience of food incentives (i.e., self-reported hunger, time since last meal, and subjective “liking” of food reward). We found that hungrier participants displayed an enhanced neural response to food rewards, as did participants who reported a longer time interval since their most recent meal. Further, self-reported snack liking interacted with RewP magnitude, such that individuals with a larger neural response to food reward displayed a stronger positive association between snack liking and eating. Our data suggest that food-related motivational state may increase neural sensitivity to food reward in young women, and that neural reward sensitivity might interact with subjective reward liking to predict real-world eating behaviour.

Funding: CIHR Canada Research Chair in Clinical Neuroscience; Fonds de Recherche du Québec – Société et Culture doctoral research award.
CAPTURING “FIGHT OR FLIGHT”: DYNAMIC MEASURES OF CARDIAC SYMPATHETIC ACTIVATION

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Descriptors: Sympathetic Nervous System, SNS Index, Pre-ejection Period

The sympathetic nervous system (SNS) reflects the body’s response to changing environmental demands. Traditional studies using cardiac SNS indices have relied largely on static methods; for example, cardiac pre-ejection period (PEP) is typically averaged by condition. Our study developed and compared a new time series analysis of two cardiac SNS measures: PEP and a novel sympathetic activation index (SAI). Nineteen undergraduates (5 male) were exposed to a virtual reality simulation of an approaching threat. ECG and impedance cardiography were recorded continuously throughout baseline, threat, and recovery, and were used to calculate PEP, which was then reported as its inverse (1/PEP) to reflect its inverse relationship to SNS. The SAI was calculated exclusively from RR interval series derived from ECG signals through a tf of coefficients associated with Laguerre base functions (Valenza et al. J. App. Phys. 2018). PEP and SAI series were normalized through a Z-score calculation. Linear regression analysis suggests a positive, linear relationship between SAI and inverse PEP (y = 0.44x + 4.8e^-17). A correlation analysis on concatenated data points found a group-wise Spearman correlation of r(51,758) = 0.216 (p < .001) and subject-wise Spearman correlation of r(17) = 0.263 ± 0.086 (median ± median absolute deviation). Both PEP and SAI provided a dynamic time series of cardiac SNS activity, revealing when experimental manipulations produced a physiological response. Such time precision may offer advances in both basic and applied intervention research.

Funding: This research was partially supported by a grant from Virginia Tech's Institute for Creativity, Arts, and Technology (ICAT), which provided funding for the purchase of a BioNomadix wireless Noninvasive Cardiac Output System (BN-NICO).

A MULTIVARIATE BRAIN SIGNATURE OF PAIN FACIAL EXPRESSION

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Descriptors: Facial expression of Pain, fMRI, MVPA

The facial expression of pain provides additional information about the pain experience, allowing us to communicate the potential presence of a threat in our environment and a need for help. In this study, we examined the brain correlates of the facial expression of pain using a multivariate approach that allows us to assess spatially distributed activity. Thirty-four (34) participants (18 women, 16 men; 23.4 ± 2.5 years old) were exposed to a total of 16 trials in which a moderately painful phasic stimulus was applied to their left leg while they were in the MRI scanner. Facial activity was recorded throughout the functional runs using an MRI-compatible camera. From the facial activity we derived a composite score (the FACs score) that we tried to predict from the brain activity (fMRI data) using the LASSO-PCR algorithm. Our results showed that the model including the whole brain activation did perform better than chance (R^2 = .19, MAE = 4.08, RMSE = 5.89, p = .01). The regions that contributed most to this prediction were the insula, the thalamus, the somatosensory cortex, the primary motor area (M1), and the supplementary motor area (SMA). Moreover, the model including only M1 did not perform better than chance (p = .86), suggesting that the motor activation of the face was insufficient to predict the facial expression of pain. By integrating the activity within the nociceptive pathway and motor areas, we were able to predict the facial expression of pain.

Funding: This study was supported by the FRQNT and IVADO research funds.
TIME-FREQUENCY DYNAMICS OF ERROR PROCESSING IN PSYCHOSIS: LINKS WITH NEGATIVE SYMPTOMS

Sam Buck, Keisha Novak, and Dan Foti
Purdue University

Descriptors: Psychosis, ERN, Time-Frequency Decomposition

Impairment of the Error-Related Negativity (ERN) has been linked to the negative symptoms of psychosis in patients with schizophrenia, and is observed in patients at clinical high risk (CHR) for psychosis. Because the ERN is computed as the average signal across multiple trials, it does not reflect non-phase locked activity present in individual trials. While the literature suggests differences between the ERN and theta-band oscillations detected after error commission, it is unclear how these different signals reflect the symptomatology within CHR. To address this, 60 members of the community (age 18–35) who met criteria for CHR completed a Flankers task while monitored by EEG. Participants were also asked to complete the Multidimensional Schizotypy Scale (MSS), a self-report measure of schizotypal symptoms. The ERN for each participant was computed, and each trial was decomposed into time-frequency space. The ERN was correlated with the severity of patients' negative symptoms, as measured by the MSS (r = 0.303, p = .02). The intensity of post-error theta power was similarly correlated with negative symptoms (r = −0.323, p = .01), finding which persisted when controlling for ERN amplitude (r = −0.342, p < .01). When only non-phase-locked power was scored, the same correlation was observed (r = −0.316, p = .01). The persistent links with symptoms across both phase-locked (ERN) and non-phase-locked activity suggests that theta power may be more than a frequency-domain analog of the ERN and may reveal a distinct but related cognitive process which is also impaired in psychosis.

Funding: This project was funded, in part, with support from the Indiana Clinical and Translational Sciences Institute funded in part by Award Number T11TR002531 from the National Institutes of Health, National Center for Advancing Translational Sciences, Clinical and Translational Sciences Award.

RELATIONSHIPS BETWEEN AUTONOMIC RESPONSES TO FEAR CONDITIONING AND THE TRIARCHIC MODEL OF PSYCHOPATHY: THE MODERATING ROLES OF BOLDNESS

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Descriptors: Boldness, Fear, Psychophysiology

There has been a longstanding interest in relationships between autonomic activity during fear conditioning paradigms and antisocial behavior and psychopathy. A considerable body of work has explored electrophysiological and cardiovascular responses both in anticipation of, and in response to, fear conditioning paradigms in antisocial participants (Hare 1965; Hare & Quinn, 1976). However, there is a lack of work exploring these associations in adolescent populations, and how these associations may relate to the triarchic model of psychopathy (Patrick, Fowles, & Krueger, 2009).

The current study examined relationships between skin conductance responses (SCRs) and heart rate reactivity (HRR) to a countdown task at ages 9–10, and the triarchic psychopathy traits at ages 9–10, 14–15, and 19–20 in a longitudinal sample (N = 695) of twins from the Risk Factors for Antisocial Behavior (RFAB; Baker et al., 2013) project. Children and adolescents high in boldness, both rated by themselves and their parents, demonstrated reduced skin conductance both in anticipation of and in reaction to the loud blast. Similar patterns were also demonstrated for heart rate (HR); children and adolescents high in boldness had less HR change during the countdown, and reduced HRR to the blast itself. Implications of these findings for our understanding of the role of boldness in autonomic reactivity to fear conditioning paradigms will be discussed.
THE REWARD POSITIVITY TO SOCIAL BUT NOT MONETARY INCENTIVES PROSPECTIVELY PREDICTS DEPRESSIVE SYMPTOMS DURING THE COVID-19 PANDEMIC

Clara Freeman, Lidia Panier, Joelle Schaffer, and Anna Weinberg
McGill University

Descriptors: Social Reward, Monetary Reward, Depressive Symptoms

The prevalence of depressive symptoms has increased during the COVID-19 pandemic, especially among those with greater pandemic-related stress exposure; however, not all people exposed to pandemic stress will develop depression. Determining which individuals are vulnerable to depressive symptoms due to this stress could lead to a better understanding of depression's etiology. This study sought to determine whether neural sensitivity to monetary and/or social reward prospectively predicts depressive symptoms during a period of stress. 121 participants attended pre-pandemic lab visits where they completed monetary and social reward tasks while electroencephalogram was recorded. From March to September 2020, we sent eight questionnaires probing depressive symptoms and exposure to pandemic-related stressors. Using multilevel models, we evaluated whether neural response to social or monetary reward predicted increases in depressive symptoms during the pandemic and whether neural response to either reward type moderated the association between pandemic-related stressors and depressive symptoms. Pandemic-related stress exposure was strongly associated with depressive symptoms. We found that blunted neural response to social but not monetary reward predicted increased depressive symptoms during the pandemic. However, neither reward response moderated the association between episodic stress and depressive symptoms. Our findings indicate that neural response to social reward may be a useful predictor of depressive symptoms under times of chronic stress and isolation.

Funding: Canada Research Chair in Clinical Neuroscience, granted to Anna Weinberg.

MULTIVARIATE ASSOCIATIONS BETWEEN REGIONAL GRAY MATTER VOLUMES AND PSYCHOPATHOLOGY DIMENSIONS IN CHILDREN

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Descriptors: Neuroimaging, Dimensional Psychopathology, Development

Prior literature has proposed that psychopathology can be conceptualized as a hierarchy of dimensional symptom domains, and that the dimensional nature of psychopathology may be mirrored in its neural substrates. While many studies of brain structure and psychopathology rely on univariate approaches, a multivariate examination of both brain regions and psychopathology symptoms is a pivotal step in understanding the multifaceted relationships between psychopathology and neurostructural variations during development. We used data from 8,218 9- to 10-year-old children from the Adolescent Brain and Cognitive Development (ABCD) Study (2015-2025). Psychopathology was measured with the Childhood Behavior Checklist (CBCL) for Social, Behavioral, and Attention Problems factors, and the Regional Gray Matter Volume (GMV) was acquired using 3T MRI. Partial and linear Least Squares (PLS) analysis, a data-driven multivariate approach, was utilized to determine which combination of GMVs maximize their covariance with the psychopathology dimensions. PLS analysis yielded one stable latent variable, which explained 97% of the variance across variable sets. Results suggest that children with higher scores on the general psychopathology factor, but also with scores on the ADHD and anxiety/somatic problems factor, show smaller gray matter volumes across the brain. These results suggest that globally smaller GMVs are a nonspecific risk factor for general psychopathology, and possibly for conduct problems and ADHD.

Funding: This research was supported by grants UG3DA045251 (awarded to BBL) from the National Institute on Drug Abuse, R01MH109898 (BBL), R01MH117014 (TMM), and R00MH117274 (ANK) from the National Institute of Mental Health, UL1TR000430 (BBL) and UL1TR000445 (BBL) from the National Center for Advancing Translational Sciences, the NARSAD Young Investigator Award (ANK), the Sloan Research Fellowship (ANK), and the Lifespan Brain Institute of the University of Pennsylvania and the Children’s Hospital of Philadelphia (TMM).

WHITE MATTER INTEGRITY AND TRANSDIAGNOSTIC SYMPTOMS WITHIN INTERNALIZING DISORDERS

Joshua Gertler, Nicola Sambuco, Margaret Bradley, and Peter Lang
University of Florida

Descriptors: Diffusion Weighted Imaging, Transdiagnostic, Internalizing Anxiety and mood disorder patients share transdiagnostic symptoms of negative affect, anxious arousal, and trauma. Studies of white matter integrity in patients and controls have observed homogeneity between and heterogeneity within specific disorders, suggesting it may be a good candidate for transdiagnostic study. This study assessed relationships between white matter integrity and transdiagnostic symptomology in a sample of 90 anxiety and mood disorder patients diagnosed with a variety of different DSM disorders. Diffusion tensor imaging (DTI, 64 directions) were acquired, followed by connectometry analysis conducted using DSI studio. Results indicated that corpus callosum integrity was reduced and cerebellum integrity increased with increases in each transdiagnostic dimension, and both heightened negative affect and anxious arousal were related to decreases in fornix and cingulum integrity. Unique associations were found for heightened negative affect and decreased integrity in emotion processing tracts, heightened anxious arousal and differential integrity in arousal and attention tracts, and heightened trauma and decreased integrity in motor tracts. These findings indicate that common reductions in corpus callosum and cerebellum white matter integrity covary with each transdiagnostic dimension, with specific transdiagnostic symptoms of negative affect, anxious arousal, and trauma uniquely related to other white matter tracts. DTI may prove useful in diagnostic assessment of patients across the internalizing disorder spectrum.

Funding: NIMH R01MH098078 UF Center for OCD, Anxiety, and Related Disorders.
LOW FREQUENCY DOMINANCE IN HUMAN SOUND LOCALIZATION IS ESTABLISHED AT THE LEVEL OF MIDDLE LATENCY RESPONSE NA

Kazunari Ikeda
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Descriptors: Sound Localization, Low Frequency Dominance, Binaural Interaction Components

In humans, horizontal sound localization is highly accurate for sounds with frequencies below 1500 Hz. In the present study, we analyzed the evoked potentials elicited by filtered clicks in order to determine the level of the auditory system at which low frequency dominance in sound localization is established. Sixteen right-handed participants received either low-passed (<1,000 Hz) or high-passed (<2,000 Hz) clicks with intensity at 30 dB SL (under binaural white noise at 38 dB A) and stimulus onset asynchrony at 180 ms. The stimulation among ears (binaural, left monaural, right monaural) was randomized in one condition and fixed to a location in the other. The auditory brainstem response (ABR) and middle latency response (MLR) were obtained from recording. We calculated the difference waveform by subtracting the left and right monaural waveforms from the binaural waveform. In the binaural and summed monaural waveforms, low frequency dominance in amplitudes (low-passed click > high-passed click) was observed and after the Pa wave. In contrast, low frequency dominance in the difference waveform amplitudes was identified at and after the Na wave. This suggests that low frequency dominance in horizontal sound localization is established not at the ABR level of the auditory system, but at the level corresponding to the Na wave.

PRINCIPAL COMPONENT ANALYSIS OF SUBTRACTED SPN BEFORE AUDITORY STIMULI

Yoshimi Ohgami1, Yasunori Kotani2, Nobukiyo Yoshida2, Hiroyuki Aka2, Akira Kunimitsu1, Shigeru Kiryu1, and Yusuke Inoue4
1Tokyo Institute of Technology, 2The University of Tokyo, 3International University of Health and Welfare, 4Kitsato University

Descriptors: Anticipation, Auditory, Language Processing

Stimulus-preceding negativity (SPN) appearing before feedback (FB) stimulus reflects anticipatory attention. Our previous study revealed that SPN consists of two components: early and late components. In this study we employed the subtraction method to remove the post-movement effect, and conducted the principal component analysis (PCA). We investigated whether the early component can be extracted after the subtraction. Participants (N = 34) performed a time estimation task where they had to press a button 4 seconds after an instruction stimulus, then feedback (FB) stimulus about task performance was presented two seconds after the button press. There were four experimental conditions: (a) beep, (b) rhythm, (c) voice, and (d) control conditions. A control condition, in which no FB stimulus was presented, was applied to remove the motor effects from the other 3 conditions. The PCA was conducted on the subtracted SPN to extract the early and late components. The results showed the existence of both early and late components in the SPN after the subtraction to remove motor-related activity, which indicates that the early component is not attributable to post-movement effects. The amplitude of early component measured at the left temporoparietal area and left occipital area in the voice condition was larger than in the rhythm condition, implying that the contents of the anticipated FB stimulus affect the early component. The present findings suggest that the anticipation of voice sounds enhances the early component, which reflects the anticipation of language processing.

Funding: JSPS KAKENHI Grant Number JP24530912.

THE RECOGNITION POTENTIAL MAY BE AN INDICATOR OF ADDRESSED PHONOLOGY

Holly Ballentine, Joseph Dien, and Donald Bolger
University of Maryland

Descriptors: ERP, Reading, Recognition Potential

In the ongoing debate between proponents of the Dual Route Cascade or DRC Model (Coltheart, Rastle, Perry, Langdon, & Ziegler, 2001) and the Triangle model (Plaut & McClelland, 1996), foremost are two related but separate issues. The first is how many pathways might exist for directly converting orthography to phonology. Here we take no position on the latter question. Instead, the interest is simply whether there is evidence for more than one pathway. We have previously hypothesized (Dien 2009; Dien, Brian, Molfece, & Gold, 2013) that what the DRC model terms addressed phonology (rote memorization of auditory word form to visual word form mapping) might be indexed by the Recognition Potential (Rudell & Hua, 1997), an N250po7. In the present study, we tested this hypothesis by examining whether the Recognition Potential would display an interaction between frequency and regularity, such that the largest amplitude would be obtained for high frequency irregular words. Sixty-nine channel EEG data were collected while thirteen participants (running paused due to COVID19) performed a lexical decision task with supraliminal masks (necessary to produce the Recognition Potential effect). We verified the Recognition Potential effect by finding the expected hemisphere by lexical interaction. As predicted, we obtained a borderline significant effect (p = .051) of frequency for the irregular words only.

Poster 1-062

“COULD YOU EXPLAIN THIS STUDY TO ME? . . . SURE.”: CONVERSATIONAL PAUSES ARE LESS SALIENT IN BROAD AUTISM PHENOTYPE

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Descriptors: Conversation Processing, P3 ERP, Autism

Pauses occur naturally during conversations, such as between hearing and agreeing to requests. Prior work has shown that affirmative responses to requests after unexpectedly long pauses (700 ms) elicit an increased P3 complex and are rated more negatively than those after normal pauses (200 ms). However, it is unclear how such biobehavioral effects may differ across the broad autism phenotype (BAP)—mild expression of autism-associated traits that include atypical processing of social communication cues. Here, we examined how BAP, measured using the BAP Questionnaire (BAPQ), may be related to differential P3 amplitudes (i.e., ΔP3) and ratings (i.e., ΔRating) between normal- and long-pause trials. We predicted that individuals with higher BAPQ scores will be less sensitive to duration of pauses and thus have smaller ΔP3 and ΔRating. Participants (N = 61) listened to and rated conversational stimuli that included 20 normal- and long-pause trials. We replicated within-subject biobehavioral effects, where long-pause trials elicited larger P3 amplitudes (r = 0.95, p < .001) and were rated more negatively (r = 0.70, p < .001) than normal-pause trials. Notably, as expected, BAPQ scores were negatively associated with ΔR(r = –.31, p = .014); however, BAPQ scores were not related to ΔRating (r = –.03, p = .831). Our findings broadly suggest that subtle differences in duration of pauses are less salient to individuals with greater autism-associated traits, warranting future work on whether such biobehavioral markers may index and inform conversational abnormalities in autism.

Funding: Brian Lamb School of Communication, Purdue University.
THETA PHASE COHERENCE IN VISUAL MISMATCH RESPONSE INVOLVED IN ACCESS PROCESSING TO VISUAL AWARENESS

Yuki Kurita, Tomokazu Urakawa, and Osamu Araki
Tokyo University of Science

Descriptors: Visual Mismatch Negativity, Unconscious, Evoked Oscillation
Electroencephalographic brain response to a deviation of preceding sequential regularity of visual events, called visual mismatch negativity (vMMN), has been well known to reflect automatic visual change detection. Our preliminary study showed a significant correlation across participants between enhancement of vMMN amplitude and facilitation of perceptual alternation on binocular rivalry when the deviant stimulus evoking vMMN was presented unconsciously. This implies that vMMN is relevant to the access processing in which the unconscious stimulus is consciously perceived. Recent studies reported that the theta band oscillation associated with vMMN had an important role in evoking vMMN (Hesse et al., 2017; Yan et al., 2017). However, it has not been clarified whether the theta band oscillation associated with vMMN has also an important role in the access processing. In the present study, we focused on inter-individual variability between event-related spectral perturbation (ERSP) or inter-trial phase coherence (ITPC) in the theta band and the proportion of perceptual alternation from before to after the presentation of deviation in the same experimental paradigm as our previous study. We found that an increase of ITPC in the theta band significantly correlated with facilitation of perceptual alternation when the deviant was presented unconsciously, but no significant difference in ERSP. The results indicated that the theta-synchronization underlying vMMN is relevant to the neural processing that the unconscious stimulus is consciously perceived.

Funding: This study was supported by JSPS KAKENHI (Grant Number: 18K19826).

THE ANTENATAL ERROR-RELATED NEGATIVITY PROSPECTIVELY PREDICTS THE IMPACT OF COVID-19 ON POSTNATAL MENTAL HEALTH VIA INCREASED INTERNALIZING SYMPTOMS ACROSS THE PERINATAL PERIOD

Elizabeth Mulligan, Norman Schmidt, Heather Flynn, and Greg Hajcak
Florida State University

Descriptors: Perinatal Mental Health, Error-related Negativity, COVID-19
The detrimental effects of the COVID-19 pandemic on mental health have increasingly been documented, yet there is a lack of research investigating predictors of the COVID-19 pandemic’s impact on mental health in perinatal women. The error-related negativity (ERN) is a well-documented biomarker of anxiety and risk for future onset of anxious disorders. In a sample of 90 women, the present study examined whether the ERN assessed in pregnancy may longitudinally predict the course of internalizing symptoms over the perinatal (i.e., around childbirth) period, as well as postpartum functional impairment in response to the COVID-19 pandemic. The ERN was assessed in pregnancy using a flankers task and was analyzed as the mean activity in the error minus correct waveform between 0 and 100 ms at the Fz electrode site. Women with an enhanced ERN in pregnancy exhibited increases in worry and depressive symptoms from pregnancy to postpartum. Additionally, increases in worry and depressive symptoms from pregnancy to postpartum were associated with increased COVID-related impairment in the postnatal period. Finally, an exploratory mediation model revealed that increased worry over the perinatal period mediated an indirect association between an enhanced ERN in pregnancy and increased postpartum COVID-related impairment. Our study provides novel evidence that the ERN predicts the course of internalizing symptoms over the perinatal period, and that the ERN may impact levels of impairment in response to significant stressors, such as the COVID-19 pandemic, by modulating worry in perinatal women.

Funding: National Institute of Mental Health R21 MH116481.
GENDER DIFFERENCES IN THE N170 RESPONSE TO EMOTIONAL FACES

Harley Renae Beach, Justin Thomas, Danielle Jones, Keanan J. Joyner, and Christopher J. Patrick
Florida State University

Descriptors: Face Processing, N170, Emotion Recognition
Research on face viewing has shown that female participants can identify gender earlier and with greater accuracy than male participants (Sun et al., 2010). Work of this kind has also revealed that when faces depict emotions such as anger or fear, female participants are more likely to identify anger when displayed on a gender-incongruent image (male) versus a gender-congruent (female) one (He et al., 2018). ERP studies have revealed that face images elicit a distinct ERP component, the N170, that is sensitive to the gender of the face being viewed. The current study built on previous research by using an emotion recognition task in which participants (N = 105; 60% F) were asked to identify the affect-category of 'NimStim' faces (happy, sad, anger, surprise, disgust, fear), with recording of EEG activity. The N170 was quantified as the mean amplitude of face-elicited activity between 150-230ms post-stimulus at electrode P8 on correctly-identified emotion trials. Comparisons for each of the six face emotions failed to replicate previously reported effects of differential N170 amplitude for male versus female faces across participants as a whole (all p's > .05). We discuss differences between the current study and past studies that may have impacted results (e.g., use of cropped NimStim faces rather than full-head Ekman faces). Behavioral effects (reaction time, accuracy) and the impact of individual differences between subjects will also be discussed.

THRUST OF SHOCK MAY INTERRUPT NEURAL PROCESSES IMPLICATED IN A TASK-SWITCH PARADIGM

Justin T. Thomas, Harley Beach, Danielle T. Jones, Keanan J. Joyner, and Christopher J. Patrick
Florida State University

Descriptors: Face Processing, Task-Switching Paradigm, Threat of Shock
Previous research using emotion-recognition and face viewing paradigms has found that female subjects recognize gender earlier and with more accuracy (Sun et al., 2010). Other work using ERPs has shown differences in N170 amplitude for faces depicting emotions of anger or fear when incongruent with the gender of the subject versus congruent (He et al., 2018). The current study extended prior research by examining the impact of potential threat (cueing for electric shock) and task-relevance of the gender of face stimuli on N170 amplitude to faces in a task-switching paradigm. College and community subjects (N = 41) viewed framed neutral and fear-congruent (female) faces tilted either to the left or right and had to identify the gender of the face or the color of the frame based on the tilt direction. Task trials were blocked, with subjects told they could receive hand shocks during some blocks, and no shocks during others; in a separate control block, subjects did not have to identify the gender of the face. Results indicated a main effect of threat on amplitude of N170 response (smaller in threat than in safe blocks), along with effects for face emotion (larger for fearful than neutral) and task-relevance of the gender of the face (smaller in task blocks that required identification of the gender of the face than in the control block). By contrast, N170 did not differ as a function of the gender of face stimuli, and no interaction effects were evident. These results indicate different control blocks). By contrast, N170 did not differ as a function of the gender of face stimuli, and no interaction effects were evident. These results indicate different potential threat and task-relevance on processing of faces of different types.

THE EFFECTS OF MENSTRUAL CYCLE PHASE ON THE LATE POSITIVE POTENTIAL TO EROTIC IMAGES

Emily G. Evans, Lauren R. Keith, Elizabeth M. Mulligan, and Greg Hajcak
Florida State University

Descriptors: late positive potential, menstrual cycle
Fluctuating reproductive hormones over the menstrual cycle have effects on emotional and cognitive processing. Prior research has shown that in the most fertile phase, the ovulatory phase, women demonstrate more attentional allocation to sexual stimuli. This is thought to occur due to increased estradiol and testosterone during the ovulatory phase. We sought to expand upon this previous research by comparing the amplitudes of event-related potentials in response to erotic stimuli over the course of the menstrual cycle. Specifically, we examined the late positive potential (LPP) which has been shown to be enhanced while viewing emotionally salient images. In a sample of 54 naturally-cycling women, we examined whether the LPP to erotic images differed between the early follicular and ovulatory phases. Order of cycle phase was counterbalanced across participants. We hypothesized that the LPP would be enhanced in the ovulatory phase as compared to the early follicular phase. The LPP was assessed during both phases using a picture-viewing task and was analyzed as the mean amplitude between 600 and 1000 milliseconds at the Pz electrode site. Results were consistent with our hypothesis: the LPP was potentiated (i.e., more positive) to erotic pictures in the ovulatory phase as compared to the early follicular phase. Our study provides evidence that neural engagement with erotic images is increased during the ovulatory phase, which bolsters previous research that suggests that women show enhanced attentional allocation to erotic stimuli during the ovulatory phase.

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ALCOHOL INTOXICATION INDUCES HETEROGENEITY IN P300 RESPONSE TO NOVEL AFFECTIVE PICTURES

Danielle N. Jones, Samantha Taylor, Keenan J. Joyner, and Christopher J. Patrick
Florida State University

Descriptors: Alcohol, Novelty P3

Acute alcohol intoxication is known to impair several neural processes. Past work has demonstrated a disruption of affective processing of visual stimuli in which alcohol selectively reduced the LPP response to aversive images in a picture viewing task (Franken et al., 2007). The present study tested for acute effects of alcohol on the Novelty-P3 response, an event-related potential (ERP) elicited by novel stimuli in a cognitive processing task and thought to reflect the orienting reflex (Barry et al., 2016). ERPs to novel pictures were measured in a visual oddball task in undergraduates randomly assigned to drink either alcohol (n=46) or a placebo beverage (n=48), or not drink at all (n=39). Novel pictures were selected from the International Affective Picture System (Lang et al., 1999) and included pleasant, unpleasant, and neutral images. An overall blunting of the Novelty-P3 was found for the alcohol group relative to placebo and control groups (r ~ .7) compared to the drinking and placebo groups (r ~ .3). Implications for understanding mechanisms of alcohol dependence will be discussed.
**Poster 2-003**

**FATIGUE IS ASSOCIATED WITH DIMINISHED CARDIOVASCULAR RESPONSE TO ANTICIPATORY STRESS IN PATIENTS WITH CORONARY ARTERY DISEASE**

Julija Gecaite-Stonciene¹, Brian Hughes², Julius Burkauskas¹, Adomas Bunевичius¹, Nijole Kazukauskiene¹, Lissiane van Houtum³, Julija Brozaitiene¹, Julius Neverauskas¹, and Narseta Mickvičienė¹

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Descriptors: Cardiovascular Response to Stress, Fatigue, Coronary Artery Disease

High levels of stress and fatigue are known to be problematic in individuals with coronary artery disease (CAD). However, studies exploring the interplay between these variables are scarce and inconsistent. Thus, we aimed to investigate the links between cardiovascular response (CR) to mental stress and fatigue in CAD patients. This cross-sectional study investigated 142 CAD individuals (85% males, 52 ± 8 years) within 2-3 weeks after acute coronary syndrome. Participants completed the Multidimensional Fatigue Inventory 20-items, the Hospital Anxiety and Depression scale and the Type D Personality, and perceived task difficulty/effort. Results indicated that CR to anticipatory stress was inversely linked with global fatigue (ΔHR: beta = −0.238; p = 0.04) and mental fatigue (ΔSBP: beta = −0.244; p = 0.04; ΔHR: beta = −0.303; p = 0.01) as well as total fatigue score (ΔSBP: beta = −0.331; p = 0.01; ΔHR: beta = −0.324; p = 0.01). To our knowledge, this is the first study to investigate psychophysiological stress response and its relationship with fatigue in an acutely ill cardiac population.

**Poster 2-004**

**INHIBITION-RELATED NEURAL ACTIVITY IN INDIVIDUALS WITH VARYING DEGREES OF SUBSTANCE USE AND SUBSTANCE-RELATED PROBLEMS**

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Descriptors: Substance Use, Inhibition-related Neural Activity, fMRI

Neural markers of inhibitory control are considered general risk factors for substance use disorders (SUDs). Yet, it remains unclear whether the association of these factors with SUDs may be attributable to differences in the degree of substance use rather than reflecting a specific link to substance-related problems. Thus, we examined whether neural correlates of inhibitory control are specifically associated with substance-related problems. (Poly-)Substance users with varying degrees of use (combination of frequency and quantity) completed a stop signal task during fMRI. They also reported substance-specific past year substance use and substance-related problems (DSM-5 SUD diagnostic criteria). We extracted individual inhibition-related neural activity (successful vs failed stops) from the stop signal task. Substance-related problems were regressed on neural activity in pre-defined regions of the inhibition network (right preSMA, bilateral IFG and AI) while controlling for the degree of use. Results indicated that less neural activation during deliberate inhibition in regions of interest from the inhibition network explained significant incremental variance in substance-related problems when statistically controlling for the degree of use. This research supports the role of functional anomalies in inhibition-related neural activation as specific risk factors for SUDs. Our results substantiate the role of a dimensional approach controlling for the degree of use for studying specific links to substance-related problems.

Funding: This work was funded by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) – Project-ID 402170461 – TRR 265, the Claussen-Simon Stiftung, and the Else Kröner-Fresenius-Stiftung (2020_EKEA.70).

**Poster 2-005**

**MODULATION OF CORTICO-KINEMATIC COHERENCE BY THE PRESENCE OF EXTERNAL ACTION-EFFECTS**

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Descriptors: Action, EEG, Motor Control

Cortico-kinematic coherence (CKC) is a measure of afferent proprioceptive activity obtained by co-recording MEG/EEG with signals registered by various (e.g., force or acceleration) sensors. Because CKC is stronger when one's fingers are passively moved than when movement is voluntary, we hypothesized that CKC may reflect the degree of reliance on proprioceptive reafference in action representation. In the present study, 15 adult participants applied force impulses in a self-paced, 2 Hz rhythm on a paper-thin force sensitive resistor pinned between the index and thumb of their dominant hand. In the motor-auditory condition force application elicited a tone, in the motor-visual condition force impulses elicited a light emitting diode flash, and in the motor condition no additional sensory effect occurred. We hypothesized that auditory or visual action-effects would allow encoding the afferent component of these consequences instead of the proprioceptive reafference, and thus CKC should be lower than in the motor condition. The 2 Hz CKC peaks were present at around the FC1, FC3 for right-handed, and FC2, FC4 electrodes for the left-handed participant. In contrast with our hypothesis, CKC was stronger when visual or auditory action-effects were present. These results indicate that CKC is modulated by the presence of external action-effects, but the pattern of results suggest that CKC is not enhanced because of attention directed to proprioception, but by a decrease of action-related sensory suppression caused by the presence of more salient action effects.

Funding: This work was supported by the National Research, Development and Innovation Fund of Hungary (K128083).

**Poster 2-006**

**MODULATION OF PERFORMANCE MONITORING BY WORRY INTERVENTIONS: AN ERP STUDY**

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University of Hamburg

Descriptors: Anxiety, Error-related Negativity (ERN), Worry

Most previous studies utilized cross sectional designs to investigate the association of anxiety and overactive performance monitoring, as measured by the error-related negativity (ERN) and correct-response negativity (CRN). A better understanding of these associations requires intervention studies that allow causal inferences. This preregistered study aimed at replicating and expanding previous findings of an ERN modulation by worry interventions. In a randomized controlled trial, n = 90 undergraduate students performed a flanker task to assess their baseline ERN (T0). Following the flanker task, we randomly assigned them to one of three groups: (1) worry induction, (2) worry reduction, and (3) passive control group. Subsequently, participants performed another flanker task to determine potential alterations of their ERN (T1). As a manipulation check, we measured state worry before T0 and T1 and before the interventions. Groups did not differ regarding demographic or clinical variables. Both experimental groups, but not the control group, reported higher state worry after the interventions. Thus, only the worry induction was successful. However, we found no differences in ERN amplitudes between T0 and T1 in any group. Regarding the CRN, all groups showed smaller amplitudes at T1. Results correspond with previous studies indicating that ERN amplitudes are independent of symptom severity and treatment outcome. Thus, our results support conceptualizing the ERN as a trait-like neural risk marker insensitive to symptom fluctuations.
GENDER DIFFERENCES IN HEALTHY OLDER CONTROLS AND OLDER ADULTS WITH SUBJECTIVE MEMORY COMPLAINTS: AN INVESTIGATION USING AN AUDITORY-VISUAL EXECUTIVE TASK

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Descriptors: Subjective Memory Complaints, Event-related Potentials, Gender

Subjective memory complaints (SMCs) are frequently observed in older adults. SMCs have been associated with deficits in executive function and an increased risk of Alzheimer's disease. The mechanisms behind the deficits in executive functions in people with SMCs and the gender-related differences in these processes are still not well understood. A total of 81 participants took part in this study and were divided into four groups: men with SMCs (n = 16); women with SMCs (n = 23); men without SMCs (n = 24); and women without SMCs (n = 18). Behavioral performance and evoked potentials were recorded during an auditory-visual executive task. We analyzed the mismatch negativity (MMN) and the P3a component associated with the reorienting negativity component (RON) associated with the reassignment of attention to relevant visual stimuli. No gender differences in memory complaints were found. We observed higher reaction times in men with SMCs than men without SMCs, but no differences in women. Importantly, the amplitude of P3a was higher in the novelty than in the deviant-standard condition only in women. Furthermore, the latency of P3a was larger in participants without SMCs than with SMCs. The amplitude of RON was greater in women and the latency of RON in the novelty-standard condition was larger for both women and men and without SMCs. However, no differences were found in the MMN parameters. We found that SMCs are associated with difficulties in executive processes, especially in men with SMCs.

Funding: This study was funded by the Ministry of Economy, Industry and Competitiveness (PSI2016-78763 and PSI2017-90806) and Generalitat Valenciana (PROMETEOII:2015-020).

GUT MICROBIOTA CORRELATES WITH FEEDBACK-RELATED NEGATIVITY

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Descriptors: Feedback-related Negativity, Microbiota, Interoception

Evaluative processing of action feedback is considered crucial for learning and adaptive adjustments of behaviour. Impaired self-monitoring is reported in several clinical conditions. The feedback-related negativity (FRN) is an event-related potential elicited by feedback presentation and generated in the anterior cingulate cortex. Although previous studies have extensively investigated external factors modulating the FRN, limited research has explored the contribution of peripheral interoceptive signals. Recent research suggests that bidirectional communications within the brain-gut-microbiota axis can modulate cognitive functioning and behaviour. Emerging evidence showed that microbial levels are associated with medial prefrontal cortex function. The present study investigates the association between gut microbiota and the FRN. Twenty-nine healthy participants completed self-report measures of depression and a Feedback and Faces task. Microbiota (Clostridium, Lactobacilli) and inflammation (C-reactive protein) were assayed from faecal and blood samples, respectively. Microbiota and depression scores were correlated with FRN amplitude. Association between microbiota and FRN was confirmed using multilevel modelling (MLM). Findings suggest that gastrointestinal tract signals are associated with central self-monitoring processes. The current work provides relevant insights into peripheral mechanisms underlying FRN generation and highlights the possible benefits of therapeutic interventions, such as microbiome treatments.

WHO GETS THE BIGGEST TREASURE? FACTORS MODULATING FORAGING DECISIONS IN HUMANS

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Descriptors: Decision Making, Foraging, Reward

In dynamic environments humans need to sequentially decide between exploitation and exploration. According to the marginal value theorem (MVT), current reward rates need to be continuously compared with potential future rewards to forage optimally. We created a Gold-treasure-task in which participants need to gain as much gold as possible within a certain time. Participants first decide between two harvesting options varying in value and probability of loss. While harvesting instantaneous reward rate (iRR) declines, participants need to decide when to leave the chosen option to achieve greater rewards elsewhere. The foraging environment varied between blocks and could be more or less advantageous. We used single-trial regressions to investigate factors influencing value-based decisions and leaving time iRR. Results show that possible gain and risk of possible loss significantly guide the value-based decision. In line with MVT, in advantageous harvesting environments participants leave the chosen option at a higher iRR. Additionally, the factors influencing the foraging decision differ between environments. By creating two different environments, we investigate adaptive foraging behavior of humans and its influencing factors. In the advantageous environment, mainly current reward-associated information seems to modulate the foraging decision, while in the disadvantageous environment, environmental history and current information seem to be crucial. Analysis of concurrently recorded EEG revealed neuronal representations of variables underlying foraging and leave decisions.
Electrocortical correlates of Risk-taking in the Hot Columbia Card Task

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Descriptors: Risk-taking, Computational Model, Single-trial EEG

To capture real-life risk-taking, laboratory tasks need to reflect its dynamic, sequential nature. The Hot Columbia Card Task (hCCT) meets this requirement and lends itself to formal analysis via computational models. We aimed to leverage these features and investigate EEG correlates of model-based factors driving risky decisions. Participants (n = 44) reported real-life risk taking and performed the hCCT while EEG was continuously recorded. A computational expected utility (EU) model explained choices best. This entailed weighting expected value (combining gain/loss magnitudes and respective probabilities) according to individual risk attitude and loss aversion. We then employed single-trial multiple robust regression within subjects to predict EEG activity during decision making at each time point and electrode from trial-wise EU. The number of risky decisions and a model-derived tendency to take risks in the face of impending losses were significantly linked to higher real-life ethical risk-taking. An EEG signal of EU emerged at centroparietal sites (300–700 ms) which shifted to a frontocentral distribution after 800 ms. Lower expected utility predicted more negative EEG signal. Computationally formalizing hCCT choices seems promising in predicting some aspects of real-life risk-taking. Neural signals of model-derived parameters validate our computational approach. Findings may indicate increased attentional processing of potential losses (P3 interval) and subsequent response preparation for high expected payoff, resembling a continuous negative variation (CNV).

Gender Differences in Psychophysiological Correlates During the Iowa Gambling Task in Healthy Older Adults

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Descriptors: Decision-making, Event-related Potentials, Gender

Past literature has demonstrated behavioral gender differences in the decision-making process, which men make more advantageous decisions and earn more money than women. A recent psychophysiological study has shown that women are more sensitive to losses than wins in young adults. However, these gender differences in the elderly are still unclear. A total of 39 healthy older participants (23 men, 16 women) performed an adapted version of the Iowa gambling task for event-related potentials. As neural correlates, we investigated the feedback-related negativity (FRN) and the P3 component, which were analyzed in the feedback stage of the decision-making process. Consistent with previous research, men reached better scores compared to women on the Iowa gambling task. Event-related potentials, showed that men obtained a large FRN amplitude in the ambiguity than the risky phase compare to women. Also, men presented a larger FRN latency than women. However, no significant gender differences were observed in the P3 component. Our results indicate that deficits in decision-making performance related to gender are persistent with aging. A greater activation of men at frontal sites in the ambiguity phase could be related to increases attentional resources in order to learn the contingencies of wins and losses. This explain why men picked more advantageous decks and earned more money than women. Therefore, these observations contribute to the heterogeneity on gender-related differences observed in both men and woman brain aging, when performing the same decision-making task.

Funding: This study was funded by the Ministry of Economy, Industry and Competitiveness (PSI2016-78763 and PSI2017-90806) and Generalitat Valenciana (PROMETEOII2015-020).

Oculomotor Indicators Can Differentiate Various Types of Inference Processes

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Descriptors: Eye Tracking, Reasoning, Cognitive Procedures

The study of the cognitive processes using eye tracking has become an increasingly popular research area. At the same time, the area of intersection between eye movements and natural reasoning is still understudied. In this work, we studied the possibilities of using such psychophysiological parameters for differentiating reasoning processes within types of logical inference. Eighty three-term inferences (two premises and the conclusion) were presented: Modus Ponens [MP], Modus Tollens [MT], Modus Ponendo Tollens [MPT], Modus Tollendo Ponens [MTP]; each type was displayed in two variants (correct and incorrect or with inclusive and exclusive disjunction, 10 stimuli in each variant). Fifteen healthy Russian speakers took part in the experiment and had to answer whether the presented argument was correct or incorrect. The response time and the oculomotor parameters (eye tracker SMI Hi-Speed, 1250 Hz) were analyzed. Significant differences in various parameters (the response time, the fixations and saccades count, the duration of fixations, the scanpath length) were obtained for different variants of the same type of inference, for correct/incorrect variants of each type of inference. The correct variant of MP significantly differ from all other correct arguments in the duration of fixations which indicates its relative simplicity and basic nature. Thus, the oculomotor parameters can be used for multidimensional differentiation of the inference processes in accordance with the various explicit and implicit levels of the related cognitive mechanisms.

Funding: This research has been supported by the Interdisciplinary Scientific and Educational School of Lomonosov Moscow State University ‘Brain, Cognitive Systems, Artificial Intelligence’.

Does Concealing Untrustworthiness Evoke Conflict Monitoring?

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Descriptors: Deception, Conflict Monitoring

Deception studies demonstrated event-related potentials (ERPs) to be promising indicators for discriminating deceptive from honest behavior utilizing underlying neuro-cognitive processes. We focused on the role of conflict monitoring as indicated by the frontal N2 component in an adapted Concealed Information Test (CITT). Stimuli consisted of faces that differed in trustworthiness and were learned prior to the task. Participants were instructed to either indicate a face to be truthfully trustworthy, truthfully untrustworthy or to conceal the actual untrustworthiness by indicating the face to be trustworthy (probe). To investigate robustness of findings across varying ERP quantification techniques, results were calculated for mean, baseline-to-peak and peak-to-peak amplitudes. Data of 30 participants (15 female; age: M = 23.73 years, SD = 4.09) revealed longer response times and lower correct rates for deceptive vs. truthful responses. A more negative frontal N2 amplitude was found for probes and truthful untrustworthy stimuli compared to truthful trustworthy stimuli when measured as mean or baseline-to-peak amplitude. Results suggest that deception involves N2-related conflict monitoring, response slowing following deceptive responses, and tendencies to avoid deception in terms of lower correct rates. Mean and baseline-to-peak amplitudes are appropriate to illustrate the picture type main effect, whereas the peak-to-peak amplitude is preferable to depict the Picture type × Condition interaction.
Poster 2-015

THE RELIABILITY OF THE P3-COMPONENT IN A 3-STIMULUS CONCEALED INFORMATION TEST

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University of Kiel, Germany

Descriptors: Reliability, P3-component, Concealed Information Test

Regarding the test economy and design of deception tasks, it is important to examine how pre-processing of EEG-data and quantification of ERPs affects the reliability of the survey. The stimulus-locked parietal P3 amplitude is associated with stimulus salience and is one of the most studied ERP components in deception tasks. Here we investigated the reliability of the P3 amplitude between 290 and 390 ms post-stimulus at Pz in a Concealed Information Test (CIT). The CIT includes probe, target, and irrelevant stimuli (initially N = 114, analyzed N = 68). We investigated the internal consistency by means of Cronbach's Alpha and split-half reliability (Spearman Brown coefficient) for 10 to 40 epochs per stimulus type and for types of ERP quantification (baseline-to-peak amplitude, peak-to-peak amplitude, mean amplitude). Cronbach's Alpha coefficients for the P3 amplitude increased with the number of epochs across stimulus types and for all quantifications. Including 40 artefact-free epochs the P3 amplitude achieved excellent Cronbach's Alpha coefficients (≥ 0.9) across stimulus type and quantification. The peak-to-peak P3 amplitude indicated excellent split-half coefficients for all stimuli, when at least 40 artefact-free epochs were analyzed. We compare reliability data for ERP-quantifications and stimulus types across CIT adaptions and for different ERPs assessed in recent deception research. We provide best-practice advices (e.g., test economy, least measurement errors) for an investigation of the parietal P3 component in a CIT with excellent reliability.

Poster 2-016

DO IMPORTANCE-RELATED FILLER ITEMS ENHANCE THE P300 CONCEALED INFORMATION TEST?

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Descriptors: Deception, Memory, Concealed Information

Lukács et al. (2017) introduced a significantly enhanced version of the Response Time-based Concealed Information Test (RT-CIT) by adding familiarity-related filler items to the standard CIT. Although further experiments replicated this result with the RT-CIT, surprisingly Olson et. al., (2020) showed that adding familiarity-related filler items did not improve the P300-based CIT. The current study aimed to verify the effect of filler items on the P300-based CIT but with the new, importance-related filler items, which were successfully introduced to RT-CIT by Wojciechowski, & Lukács (2021). The main advantage of the new version of fillers is that, in contrast to the previous version, they are likely to generalize to any type of memory. 41 participants took part in an experiment in which they were asked to commit a mock-crime (stealing a piece of jewelry) and to attend a P300-CIT. Participants were randomly assigned to the classic P300-based three stimulus protocol (n = 21) or an enhanced P300-CIT with importance-related fillers (n = 19). Consistent with Olson et al., (2020), the results showed that importance related fillers enhanced the RT-CIT but did not improve the P300 CIT.

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Poster 2-017

AUTOMATIC OR MANUAL IC SELECTION: WHICH TYPE OF EYE MOVEMENT CORRECTION SHOULD BE PREFERRED?

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Descriptors: Adjust Algorithm, Parietal P3 Component, Independent Component Analysis

We compared an automated and a non-automated (manual) selection of independent components (IC) to correct data of the electroencephalogram (EEG) for eye movement artifacts. The automated independent component analysis used the Adjust procedure (Mignon et al., 2011). A total of N = 45 participants (aged: M = 22.16 years, SD = 3.31, range: 18–31; n = 10 men) performed a deception paradigm using technically correct and erroneous diagrams. Participants were asked to conceal knowledge of errors following three of six erroneous diagrams. To the other three erroneous diagrams participants responded truthfully as well as to the correct diagrams. The EEG was recorded for 64 active electrodes (Biosemi, Netherlands), two horizontal, and one vertical electrooculogram (EOG) electrodes. We compare the internal consistency coefficients (n = 31) for mean early parietal P3 data (300–400 ms post-stimulus) of probe stimuli (i.e., participants concealed knowledge of erroneous diagrams successfully) pre-processed with an automated and manual IC selection procedure, respectively. The number of IC components selected by the automated and the manual procedure did not significantly differ. Starting with five artefact-free probe epochs revealed a moderate Cronbach’s Alpha coefficient, whereas 15 artefact-free probe epochs resulted in an excellent Cronbach’s Alpha coefficient for data that were pro-processed with an automated IC selection. Cronbach’s Alpha for manually processed data were excellent reliable with at least 10 artefact-free probe epochs. We discuss implications of both IC procedures.

Poster 2-018

MOTIVATED TO HARM OTHERS? PREFRONTAL-POSTERIOR COUPLING IN RESPONSE TO OTHERS’ DESPAIR AND ANGER IS LINKED TO MALEVOLENT CREATIVITY

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University of Graz

Descriptors: EEG Coherence, Malevolent Creativity, Social-emotional Processing

Malevolent creativity refers to creative ideas purposely generated to damage others. People high in malevolent creativity may find it rewarding to see their social interaction partners upset or hurt. This may be reflected in the brain’s responses to others’ emotional states. We examined if phasic changes in the functional coupling of the prefrontal and posterior cortex from rest to social-emotional processing predict scores on the Malevolent Creativity Test (MCT). During EEG, n = 74 participants listened to other people’s laughter, desperate crying, and anger. Here, a right-hemispheric reduction in prefrontal-posterior coupling signals deeper emotional absorption, i.e., being more affected, while an increase in coupling denotes greater detachment, i.e., being less affected. Participants then generated as many original ideas as possible in order to take revenge on wrongdoers (MCT). Greater relative decreases of prefrontal-posterior coupling during others’ crying correlated with greater MCT fluency. This may indicate that people who find others’ despair rewarding on a neuronal level, are more motivated to generate a large pool of ideas, maximizing their chances of hurting others. Greater relative increases of coupling during other’s anger were linked with greater ideational malevolence, suggesting that people who are unperturbed by others’ aggression take greater risks with their damaging ideas, as they are indifferent to retaliation. Our results offer novel insights into neural trait dispositions that may help understand individuals’ potential for creative destruction.
**Poster 2-019**

**ELECTROPHYSIOLOGICAL MARKERS OF THE SENSE OF AGENCY: CONTRIBUTIONS OF TEMPORAL PROXIMITY, TEMPORAL ORDER AND ACTION-EFFECT CONGRUENCY**

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The auditory N1 was modulated only by temporal proximity, supporting previous findings that N1 attenuation may be at least partly due to the mere proximity to a motor act. ERPs with a latency of around 200 ms were strongly modulated by temporal order and congruency. Congruent sounds preceding button presses by up to 60 ms were predominantly judged as SG. ERPs during this illusory agency time window were characterised by an attenuated N200. Our results suggest that ERPs in the 200 ms range are potential predictors of the sense of agency, as they directly reflect temporal or identity predictions, rather than sensory attenuation at earlier latencies, which seems to be related mainly to unspecific motor effects.

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**Poster 2-020**

**EEG BIOMARKERS OF MASTERY IN TEAM SPORTS**

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Descriptors: Team Sports, Sports Mastery, EEG

Improving the training process requires the identification of neurobiological markers, which make it possible to judge a steady increase in the sports mastery and/or correct, increase the effectiveness of the training process. Changes in the electrical activity of the brain during intensive muscle loading, physical exertion may be objective markers reflecting an increase in sportsmanship, indicating more effective motor, cognitive aspects, and emotional processes.

The aim of the present study includes revealing the changes in the brain activity of athletes in the process of sports mastery and/or correct, increase the effectiveness of the training process. Information processing. The aim of the present study includes revealing the changes in the brain activity of athletes in the process of sports mastery and/or correct, increase the effectiveness of the training process. Changes in the electrical activity of the brain during intensive muscle loading, physical exertion may be objective markers reflecting an increase in sportsmanship, indicating more effective motor, cognitive aspects, and emotional processes.

**Poster 2-022**

**ALTERED FUNCTIONAL CONNECTIVITY UNDER EMOTIONAL BURNOUT (EXHAUSTION STAGE)**

Sergii Tukaiev1, Dmytro Harmatiuk1, Anton Popov2, and Mykola Makarchuk1
1Taras Shevchenko National University of Kyiv, 2Igor Sikorsky Kyiv Polytechnic Institute

Descriptors: Functional Connectivity, Emotional Exhaustion, Burnout

The neurophysiological mechanisms of emotional burnout remain insufficiently studied. It was found that EEG changes during burnout differ from biomarkers of depression and chronic fatigue syndrome. To establish the EEG markers of burnout was our aim. 182 volunteers, first-third year students from the National Taras Shevchenko University of Kyiv aged 18 to 24 years participated in this study. EEG was recorded during the resting state (3 min, closed eyes condition). The interhemispheric and intrahemispheric average coherence across all EEG segments in all frequencies from 0.2 to 45 Hz was estimated. Psychological testing was performed before the registration of EEG. To determine the formation of emotional burnout Boyko’s “Syndrome of emotional burnout” Inventory was used. The Exhaustion phase of emotional burnout was formed in 13 participants, and it was under development in 47 participants. In background EEG activity during the development of the exhaustion variations in EEG spatial synchronization were observed in low- and high-frequency EEG components. Development of exhaustion includes breaking of parietal-occipital links (alpha2,3-subbands) and formation of interhemispheric prefrontal, anterior frontal, and frontal links (alpha1,2-subbands). There were interruptions of coherence in the beta (interhemispheric frontal-frontal and parietal-parietal links) and beta2 subbands (right interhemispheric frontal link). Showed changes in functional connectivity under exhaustion development indicate the involvement the attention focusing, working memory, and emotional processes.

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**Poster 2-023**

**ALTERED FUNCTIONAL CONNECTIVITY UNDER EMOTIONAL BURNOUT (EXHAUSTION STAGE)**

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1Taras Shevchenko National University of Kyiv, 2Igor Sikorsky Kyiv Polytechnic Institute

Descriptors: Functional Connectivity, Emotional Exhaustion, Burnout

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DOES INTOLERANCE OF UNCERTAINTY AFFECT EMOTIONAL PREDICTIONS? A HIGH-DENSITY EEG INVESTIGATION

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Descriptors: Intolerance of Uncertainty, Emotional Prediction, SI-S2 Paradigm

Emotions were reconsidered as predictive models, constructed by the brain (generation stage) to prearrange action (implementation stage), and update internal models according to incoming stimuli (updating stage). Predictive models are then weighted depending on the experienced level of contextual uncertainty. Intolerance of Uncertainty (IU) can exert a strong modulating influence on emotional predictions, however the underlying neural mechanisms are still unclear. We investigated through hd-EEG whether IU predicted ERP amplitudes and estimated brain source activity developing along the stages of emotional predictions, as a function of contextual uncertainty. Thirty-six participants underwent a SI-S2 paradigm, with both emotional faces and pictures as S1s and S2s, respectively. Contextual uncertainty was manipulated across three blocks, in which S1 was predictive of S2 in 100%, 75%, or 50% of trials. ERPs, brain sources and their relationship with IU were analyzed in each stage. IU did not affect the generation stage. During the implementation stage, IU predicted larger CNV in the 75% block, and lower activation of the left anterior cingulate cortex/ supplementary motor area, indicating heightened attention allocation in order to compensate for a disrupted assessment of uncertainty. During prediction updating, IU was associated with (i) lower P2 to positive S2s, suggesting reduced processing of safety cues; (ii) lower P2 and LPP in the 75% block, and (iii) reduced right orbito-frontal cortex activity to emotional S2s, indexing disrupted access to emotion regulation strategies.

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HEART RATE VARIABILITY IS ASSOCIATED WITH AMYGDALA-OCCIPITAL CORTEX CONNECTIVITY STRENGTH

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Descriptors: Heart Rate Variability, Functional Connectivity, Amygdala

Heart rate variability (HRV) is a peripheral index of flexible, top-down control. Prior neuroimaging research reported a positive association between HRV and resting amygdala-medial prefrontal cortex (mPFC) connectivity strength. The current study sought to conceptually replicate and extend findings using ER task-based connectivity. Seventy participants (52 old, 18 young; 51% male) were instructed to cog-regulate (ER), with heart rate variability (HRV) serving as a peripheral marker of inhibitory cortical-subcortical functioning for supporting adaptive emotion regulation (ER), with heart rate variability (HRV) serving as a peripheral index of flexible, top-down control. Prior neuroimaging research reported a positive association between HRV and resting amygdala-medial prefrontal cortex (mPFC) connectivity strength. The current study sought to conceptually replicate and extend findings using ER task-based connectivity. Seventy participants (52 old, 18 young; 51% male) were instructed to cognitively reappraise negative affective images in the scanner. HRV measures were derived from a pulse signal recorded during the task. No significant associations were found between HRV and amygdala-mPFC connectivity strength. However, whole-brain analyses revealed that individuals with higher HRV demonstrated stronger left amygdala connectivity with several visual processing regions (i.e., superior lateral occipital cortex, lingual gyrus), potentially reflecting increased engagement with negative affective material and/or greater use of attentional regulation mechanisms. Current findings do not support the NIM nor conceptually replicate resting-state connectivity findings. Future research should examine HRV and dynamic brain states to further investigate transient changes in neural networks that support flexible self-regulation across different contexts.

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THE FINE-TUNED INTERPLAY BETWEEN ATTENTION AND EMOTION IN DYSPHORIA: AN ERP AND CARDIAC DECCELERATION STUDY

Tania Moretta, Elisal Bo, Carla Dell’Acqua, Simone Messerotti Benvenuti, and Daniela Palomba

University of Padova

Descriptors: Depressive Symptoms, Event-related Potentials, Cardiac Deceleration

The complex interplay between emotions and the distinct stages of attentional processing in dysphoria, or subclinical depression, has yet to be investigated in a single study. Accordingly, the present study represents the first attempt to assess whether and how emotions affect both short-term motivated and sustained attention in dysphoria. To this end, the amplitude of P3/Late Positive Potential (LPP) complex and cardiac deceleration were assessed during the passive viewing of pleasant, neutral, and unpleasant pictures in 26 individuals with dysphoria and 25 healthy controls. Cluster-based pairwise comparisons showed a significant positive centro-parieto-occipital cluster for the difference between the two groups. Specifically, individuals with dysphoria showed a smaller P3/LPP amplitude in response to both pleasant and neutral, but not unpleasant, stimuli than controls. Interestingly, individuals showed enhanced cardiac deceleration when viewing pleasant compared to neutral pictures (3–6 s time window), only individuals with dysphoria showed a prolonged cardiac deceleration in response to unpleasant stimuli as compared with neutral ones. This study suggests that dysphoria is characterized by reduced motivated attentional allocation to positive information and by prolonged attention to unpleasant stimuli in later stages of processing. Overall, these findings provide new insight into the characterization of valence-specific attentional processes in dysphoria as potential vulnerability factors for depression.

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HEART RATE VARIABILITY: TOWARDS BIOMARKERS OF INTERGENERATIONAL RISK FOR DEPRESSION

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Descriptors: Affective Touch, Hunger, fMRI

Hunger constitutes one of the strongest motivators in the animal kingdom with the potential to override almost all competing incentives. While short-term hunger is ubiquitous in our daily lives, we do not know whether it is strong enough to override strong interpersonal incentives such as affective touch. Thus, this neuroimaging study investigated whether touch reward is influenced by one’s metabolic state. In a within-subject study, 60 participants (46 women) remained once fasted, while they started the other test session with a standardized meal. All rated pleasantness and stimuli intensity for slow (0.3 cm/s), CT-targeted (3 cm/s), and fast (30 cm/s) touch applied to the right shin. For 45 participants (11 women), 3T fMRI data were collected during touch processing. Touch was rated as more pleasant when participants were satiated than when fasted. Additionally, participants rated CT-targeted touch as most pleasant. In accordance, brain activation was enhanced in the right supramarginal gyrus and bilateral paracingulate areas during CT-targeted touch when participants were satiated compared to fasted (cluster-level FWE-corrected p < .05). The more participants reported to enjoy CT-targeted touch when satiated compared to being fasted, the higher the corresponding activation levels in paracingulate areas. Our results are in line with animal studies on motivational hierarchies, as fasting obviously decreased the pleasantness of affective touch. This suggests that metabolic needs can overshadow the rewarding effects of otherwise pleasant stimuli provided in another modality.

Funding: This study was funded by the Research Council of Norway (NFR, project number 275316).
THE INTERPLAY BETWEEN AFFECTIVE DISPOSITION AND COGNITIVE PROCESSING IN DYSPHORIA: A TIME-FREQUENCY EEG STUDY

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University of Padua

Descriptors: Depressive Symptoms, Time-frequency, Affective Disposition

The interplay between dysregulated affective disposition, indexed by reduced emotional responding to pleasant stimuli, and the increased cognitive processing of unpleasant stimuli in individuals with depressed mood is still unclear. Time-frequency analysis of electroencephalographic activity allows disentangling the brain's parallel processing of information. Therefore, the present study employed a time-frequency approach to simultaneously examine affective disposition and cognitive processing during the viewing of emotional stimuli in dysphoria. Time-frequency event-related changes were examined during the viewing of pleasant, neutral, and unpleasant pictures in 24 individuals with dysphoria and in 24 controls. Affective disposition was indexed by delta and alpha power, whereas theta power was employed as a correlate of cognitive elaboration of the stimuli. Cluster-based statistics revealed a centro-parietal reduction in delta power for pleasant stimuli in individuals with dysphoria than controls. Also, dysphoria was characterized by an early (0–666 ms) fronto-central increase in theta power for unpleasant stimuli relative to neutral and pleasant. Instead, controls were characterized by a late (836–1,400 ms) fronto-central and occipital reduction in theta power for unpleasant stimuli relative to neutral and pleasant. The present study employed novel insights on the interrelated facets of affective elaboration in dysphoria, mainly characterized by a hypoactivation of the approach-related motivational system and a sustained facilitated cognitive processing of unpleasant stimuli.

Funding: The study was supported by a grant from MIUR (Departamenti di Eccellenza DM 11/05/2017 n. 262) to the Department of General Psychology, University of Padua, and by a grant from MIUR (PRIN n. 2017BC4MST) to Prof. Daniela Palomba. Simone Messerotti Benvenuti's work was supported by the University of Padua under the 2019 STARS Grants programme (Acronym and title of the project: A-CAOS-BIRD - Asymmetries and Connectivity in Alpha Oscillations: toward Biomarkers of Intergenerational Risk for Depression).

Poster 2-028

NOT ONLY FEAR BUT ALSO SAFETY SIGNALS MODULATE VISUAL CORTEX RESPONSES TO ENHANCE DISCRIMINATION OF NEURAL STIMULUS REPRESENTATIONS

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Descriptors: Fear Conditioning, Gamma Band, Visual Cortex

A selective and rapid adaptation to new environmental information about potential threat signals is crucial for the survival of organisms and have to be discriminated effectively. Here, we investigated changes of the neural representation of fear relevant and irrelevant visual cues during fear conditioning. We recorded early evoked gamma band responses in visual cortex with MEG in human subjects (N = 30) using two orthogonally oriented Gabor patches as conditioned stimuli (CS) and a 90 dB acoustic noise as the unconditioned stimulus (US). The experiment consisted of an habituation block (no pairing of the US with a CS), followed by an acquisition phase (paring of the US with the 45° oriented CS+), and terminated by an extinction phase (no presentations of the US). The CS− (safety, −45°) was never paired with the US. Time-frequency analysis revealed a selective increase of early evoked gamma band responses (20 to 70 Hz) during the first 180 ms after stimulus onset for the CS+. During acquisition, gamma band activity was associated with sensory amplification and may facilitate fear and avoidance. Here we induced predictable and unpredictable respiratory threat in healthy young adults and measured the effects of the presence and predictability of threat on respiration and neural responses. 50 participants breathed through a respiratory circuit in 3 conditions: Safe (normal breathing), Predictable (cued loaded breaths), and Unpredictable (uncued loaded breaths). We administered paired occlusions every 2–6 breaths to measure inspiratory pressure change and, using EEG, measured peak N1 responses, and the peak N1 response to the 2nd over the 1st occlusion (neural gating ratio S2/S1). We measured respiratory rate (RR), inspiratory and expiratory pressure (PiMax), and tidal volume (Vt) for unloaded, unoccluded breaths in each condition. We found that the presence of respiratory threat significantly increased participants’ Vt, PiMax, and Vt’. We found no effects on RR and neural responses to occlusions, and no unpredictability effects. Overall, threatening respiratory contexts appear to induce several systematic respiratory changes, which may translate into chronically disordered breathing in certain conditions. More research is needed, particularly in patients, to gauge the relevance of these results for clinical practice.

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Poster 2-029

THE INFLUENCE OF (UNPREDICTABLE) RESPIRATORY THREAT ON RESPIRATORY PARAMETERS AND NEURAL PROCESSING

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KU Leuven

Descriptors: Interoceptive Threat, Respiration, Neural Processing

Patients with chronic respiratory complaints may come to associate certain contexts or activities with the incidence of symptoms, which can lead to subsequent avoidance and further limitations in the quality of life. Unpredictable symptoms are usually perceived as more distressing and may facilitate fear and avoidance. Here we induced predictable and unpredictable respiratory threat in healthy young adults and measured the effects of the presence and predictability of threat on respiration and neural responses. 50 participants breathed through a respiratory circuit in 3 conditions: Safe (normal breathing), Predictable (cued loaded breaths), and Unpredictable (uncued loaded breaths). We administered paired occlusions every 2–6 breaths to measure inspiratory pressure change and, using EEG, measured peak N1 responses, and the peak N1 response to the 2nd over the 1st occlusion (neural gating ratio S2/S1). We measured respiratory rate (RR), inspiratory and expiratory pressure (PiMax), and tidal volume (Vt) for unloaded, unoccluded breaths in each condition. We found that the presence of respiratory threat significantly increased participants’ Vt, PiMax, and Vt’. We found no effects on RR and neural responses to occlusions, and no unpredictability effects. Overall, threatening respiratory contexts appear to induce several systematic respiratory changes, which may translate into chronically disordered breathing in certain conditions. More research is needed, particularly in patients, to gauge the relevance of these results for clinical practice.

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Poster 2-030

EFFECTS OF DIFFERENT CRAVING REGULATION STRATEGIES AND RE-EXPOSURE ON CUE-INDUCED CRAVING AND NEURAL PROCESSING IN SMOKERS

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Technische Universität Dresden

Descriptors: Craving, Regulation, EEG

Cognitive regulation of craving is a promising approach in addiction treatment. reappraisal and distraction differ in how deeply craving-inducing cues are processed. We compared these strategies regarding their long-term effects on subjective craving and searched for an EEG correlate like the late positive potential (LPP), which was previously shown to reflect emotion regulation. Fifty-seven smokers viewed smoking-related pictures and focused on long-term negative (LATER) or short-term positive (NOW) consequences of smoking or engaged in an arithmetic task (DISTRACT). After a break, all pictures were presented again without regulation (re-exposure). MEG was continuously recorded and subjective craving was rated after each picture. During regulation, craving was lower in the LATER and DISTRACT than in the NOW condition. In the re-exposure phase, lower craving followed pictures connected with LATER compared to DISTRACT and NOW conditions. The LPP captured some but not all of these modulations. We conducted an exploratory single-trial regression analysis (STA) to predict trial-wise EEG through subjective craving. A model including NOW and DISTRACT regulation trials revealed a protracted positive relationship of EEG activity and craving at midline recording sites. A model including NOW and LATER regulation trials showed a transient relationship at central-right recording sites. No effects were found in the re-exposure phase. The results show that the STA confirms the LPP in parts but seems to lack the power to reproduce the small behavioral effect during re-exposure.

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EFFECTS OF TRANSCUTANEOUS AURICULAR VAGUS NERVE STIMULATION (tA VNS) ON INTEROCEPTION
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Descriptors: Interoception, Neurostimulation, Heart Rate

Interoception is understood as the mental representation of one’s bodily changes and it is assumed to be mediated by activation of the afferent branch of the vagus nerve (VN), path by means of which information about internal conditions of the body is transmitted to cortical regions. To directly test whether interoceptive processing is causally linked to VN activation we therefore applied non-invasive transcutaneous auricular VN stimulation (tA VNS). A tA VNS-sham, 2-day, within-subject, crossover design was implemented, in which participants underwent a heart-beat counting task and a time estimation task. The tasks were performed in three blocks, one prior (i.e., baseline) and two during active and sham stimulation. The effects of stimulation on interoceptive accuracy, sensibility, and awareness were tested using linear mixed models. Preliminary results (N = 24) revealed that interoceptive accuracy and awareness tended to decline during sham stimulation compared to baseline. This tendency, however, was reduced (i.e., interoceptive awareness) or even reversed, (i.e., interoceptive accuracy) during tA VNS. Interoceptive sensibility was not affected by stimulation. These findings provide preliminary evidence for a causal role of VN activation on some aspects of interoceptive processing.

Poster 2-032

BENEFICIAL EFFECTS OF NON-INVASIVE VAGUS NERVE STIMULATION FOR BURNOUT
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1National Taras Shevchenko University of Kyiv, 2BrainPatch Ltd., 3Beehive Academy and R&D Labs

Descriptors: Vagus Nerve Stimulation, Neurormodulation, Burnout

Vagus nerve stimulation (VNS) as a modern effective method of neuromodulation produces therapeutic effects for the treatment of neuralgia, psychiatric disorders, heart failure, and others. The aim of the current study was to evaluate the effects of the non-invasive vagus nerve stimulation on emotional burnout. Six right-handed male volunteers aged 18–22 years participated in VNS study. We used the combination of pleasant meditative classical music and a slow bi-polar wave (0.1–0.2 Hz) of electrical non-invasive auricular vagus nerve stimulation for 5 min. The set of 4 VNS was performed at intervals of 3 days. EEG was registered during the rest state (3 min). To measure the severity of emotional burnout in students, we used the 22-item Maslach Burnout Inventory (MBI). VNS significantly improve the depersonalization and reduction of personal achievements (components of the emotional burnout). Changes in the psychomotional state of the respondents were accompanied by the following changes in brain activity. The observed increase in the theta/Fz/alpha-Pz ratio reflects an enhancement of the activation level under VNS. VNS leads to an increase in the level of activation (the ratio of beta/alpha rhythms). The changes in the power of the alpha rhythm may relate to improving of mental process, creativity, creative thinking. An increase in alpha rhythm may reflect internally oriented attention in creative activities. We suggest that the novel mastoid stimulation device may have a prolonged stimulating effect on the brain processes while attenuating the burnout at the same time.

Poster 2-033

MAINTENANCE OF EEG THETA/BETA RATIO AND ATTENTIONAL PERFORMANCE IN APPLICATION OF A HEPA/UV AIR PURIFIER COMPARED TO WEARING THE FFP2 FACE MASK
Diana Henz
University of Oxford

Descriptors: EEG, Air Purifier, FFP2 Face Mask

Literature shows that changes in breathing behaviour is accompanied by changes in EEG brain activity. In the present study, the effects of the application of an air purifier were compared with those of wearing a face mask with respect to EEG theta/beta ratio and attentional performance. The air purifier studied was a combined HEPA/UV and electromagnetic interference suppression technology device (Gabriel-Tech CF-8609S) that eliminates 99.99% of bacteria and viruses, whilst the mask used conformed to FFP2 standards. The following experimental conditions were tested: application of air purifier without mask, application of air purifier with mask, wearing of face mask only, control condition. Each experimental condition was tested for 15 min under resting conditions as well as performance of an attentional test (d2-R test). High-density EEG was recorded from 128 electrodes (10-5 system) before, during, and after each experimental condition. Results showed highly significant increases in frontal theta/beta ratio when wearing the FFP2 face mask compared to application of the air purifier without face mask, and the control condition. Attentional performance (overall performance, mix-up errors) decreased in the face mask conditions compared to the air purifier condition, and control condition. Results indicate that application of the FFP2 face mask increases frontal theta/beta ratio which is associated with mind wandering and activation of the default mode network. Application of the air purifier leads to a maintenance of theta/beta ratio and attentional performance.

Poster 2-034

SHIELDING CHIPS REDUCE EFFECTS ON EEG BRAIN ACTIVITY INDUCED BY ELECTROMAGNETIC RADIATION IN THE 5G RANGE
Diana Henz
University of Oxford

Descriptors: EEG, Shielding Chips, 5G

Current literature shows adverse effects of electromagnetic fields (EMFs) emitted by mobile phones on EEG brain activity. In previous studies, it was shown that shielding chips that are applied to mobile phones reduced the effects of mobile phone-emitted EMFs on brain activity. In the present study, the effects of shielding chips on brain activity when subjects were exposed to mobile phone radiation in the 5G range were investigated. Subjects were exposed to EMFs emitted by a smartphone (Apple iPhone 12 Pro 5G) receiving a call. The following experimental conditions were tested: smartphone call with application of a shielding chip, control condition with smartphone switched off. Each condition was tested for 15 min. High-density EEG was recorded from 256 electrodes applied according to the international 10-5 system. Recordings were taken before, during, and after each experimental condition. Results showed increases in EEG beta and gamma activity in frontal, temporal, parietal, occipital, and in limbic areas when subjects were exposed to the smartphone without application of a shielding chip compared to the control condition. EEG beta and gamma activity significantly decreased in frontal, central, temporal, parietal, occipital, and limbic areas when the shielding chip was applied compared to the condition without shielding chip. Results indicate that application of the shielding chip reduces increases in brain activity induced by smartphone-emitted EMFs in the 5G range.
ANXIOUS APPREHENSION INFLUENCES STARTLE AND P300 IN THREAT ANTICIPATION

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Descriptors: Startle Reflex, Event-related Potentials, Worry

A widely shared framework suggests that anxiety symptoms map onto two dimensions: Anxious apprehension and anxious arousal. Previous research associated individual differences on these dimensions with different neural response patterns. Thus, effects of the anxiety dimensions might contribute to inconsistencies in clinical and non-clinical studies that examine neural processes underlying anxiety. The present study therefore tested associations between the anxiety dimensions and the neural processing of threat anticipation. From a larger online sample (N = 1,603), we recruited 101 subjects with converging and diverging anxious apprehension and anxious arousal profiles. The subjects underwent the NPU-threat test with alternating phases of predictable threat, unpredictable threat, and safety. Physiological responses (i.e., startle, N100, and P300) to auditory startle probes were recorded. Results show that anxious apprehension predicted enhanced startle to unpredictable threat. Further, anxious apprehension decreased attentional allocation (P300) to predictable threat. No evidence emerged for anxious arousal affecting threat anticipation. This suggests that trait variations in anxious apprehension shape the dynamics of neural processing of threat stimuli. Anxious apprehension simultaneously increases the defensive preparation during uncertain threat anticipation and attenuates attentional responding to predictable threat. However, we could not validate a role of anxious arousal in threat processing. Altogether, our data further highlight the role of uncertainty in anxiety.

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Poster 2-035

GENETIC ASSOCIATION OF NEUROTROPHIC TYROSINE KINASE RECEPTOR, TYPE 3 (NTRK3) RS2229910 WITH INTERNET ADDICTION IN SIBERIAN ADOLESCENTS: A REPLICATION CASE-CONTROL STUDY

Sergey Tereshchenko, Marina Smolnikova, and Margarita Shubina
Scientific Research Institute for Medical Problems of the North

Descriptors: Internet Addiction, Adolescents, Genetic Predisposition

One of the main challenges in the development of the bio-psychosocial model of Internet addiction (IA) is to determine which genes and neuromodulators are responsible for increased addiction susceptibility. In a pilot targeted exome sequencing study has been shown that NTRK3 variants are associated with IA in male Korean adults (Kim et al., 2016). To our knowledge, no replication of this study in the adolescent population has been published so far. Methods: 272 urban Russian Slavs (Krasnoyarsk, Abakan; Siberia) adolescents aged 12–18 were tested with the Chen Internet Addiction Scale (CIAS). Based on the CIAS score, Internet users were categorized into three groups: adaptive Internet users (AIU); maladaptive Internet users (MIU); and pathological Internet users (PIU). For each case of PIU/MIU adolescents, a corresponding AIU group was created. For each group, the total score of SPM Plus and all metrics in all frequency bands. Correlation analysis revealed negative association between Intelligence and Modularity in beta band (r = -0.63, p corrected = .0253). These results correspond to the principle that lower modularity is associated with state of relative integration, but not segregation (Girri, Mills, Christoff, 2019), to lower modularity can be related to general cognitive efficiency of global information processing. Conclusion. The obtained results can clarify associations between intelligence and EEG resting-state global networks in different frequency bands.

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Poster 2-038
TRACKING OBJECT PROCESSING AND VISUAL PERSPECTIVE TAKING IN INFANTS AND ADULTS

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Descriptors: Steady-state Visual Evoked Potential, Visual Perspective Taking, Object Representation

From early on, infants seem to track what others see (visual perspective taking), and recent research indicates that this may also affect their own representation of the environment. This influence of others on one’s own representation has been observed in adults and has been referred to as allocentric modality. Here, we use the steady-state visual evoked potential (ssVEP) as a neural marker of object representation and probe to what extent the presence and visual perspective of an agent modulates infants’ and adults’ object processing. To this end, we presented 10-months-old infants and adults with videos in which flickering objects move across a table (visual on-off stimulation at 4 and 6 Hz). We manipulated whether (1) the scene was experienced together with or without an agent and (2) the agent’s visual access to the object. More specifically, at the end of each trial, the object either disappeared into a tunnel (no visual access) or behind an occluder (continued visual access for the agent). We hypothesize a sustained ssVEP response in the occluder compared to the tunnel condition as the agent still has visual access to the object. Preliminary data (of \(N = 15\) infants, \(N = 30\) adults) confirms that infants and adults show enhanced neural activity at the entrained frequency while the object is presented. This activity declines continuously with the disappearance of the flickering object. We will contrast the ssVEP time course between frequencies, and report power differences between conditions.

COORDINATING WITH A ROBOT PARTNER AFFECTS ACTION MONITORING RELATED NEURAL PROCESSING

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Descriptors: EEG, Human-Robot-Interaction, ERP

Robots start to play a role in our social landscape, and they are progressively becoming responsive, both physically and socially. It begs the question of how humans react to and interact with robots in a coordinated manner and what the neural underpinnings of such behavior are. This exploratory study aims to understand the differences in human-human and human–robot interactions at a behavioral level and from a neurophysiological perspective. We adapted a collaborative dynamical paradigm from Hwang et al. 16 participants held a tablet while guiding a ball around a circular track with either another participant or a robot. In irregular intervals, the ball was perturbed creating an error in the behavior, which required corrective measures to return to the track. Concurrently, we recorded EEG. In the behavioral data, we found an increased velocity and positional error in the human-human vs. human-robot condition. For the EEG, we computed ERPs. To explore the temporal and spatial differences in the two conditions, we used time-regression with overlap-control and corrected for multiple-comparisons using TFCE. We found a difference between human and robot partners driven by significant clusters at centro-frontal electrodes. The amplitudes were stronger with a robot partner, suggesting a different neural processing. Overall, our study suggests that coordinating with robots affects action monitoring related processing as human participants treat errors during human-robot interaction differently than those made during interactions with other humans.

A POOLED PRELIMINARY ANALYSIS ON THE EFFECTS OF TRANSCUTANEOUS AURICULAR VAGUS NERVE STIMULATION ON SALIVARY ALPHA-AMYLASE AS NORADRENERGIC BIOMARKER

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Descriptors: Transcutaneous Auricular Vagus Nerve Stimulation, Salivary Alpha-amylase, Pooled Data

There is multiple evidence pointing to a modulatory role of transcutaneous auricular vagus nerve stimulation (taVNS) on cognitive and affective functions, which is likely mediated by activation of the locus coeruleus-noradrenaline (LC-NA) system. However, reliable effects of taVNS on noradrenergic biomarkers have not been demonstrated yet. Possible reasons for this lack of replicability are relatively small sample sizes and the heterogeneity of stimulation procedures used across studies. The aim of the present study is to overcome these limitations by pooling existing data across labs that examined the effects of taVNS on salivary-alpha amylase (sAA), a putative indirect marker for noradrenergic activity. sAA data from four of our taVNS studies with healthy subjects (\(N = 147\)) were analyzed using linear mixed models with log-transformed sAA data as predicted variable, and stimulation type (taVNS or sham stimulation) and time (before or after stimulation) as predictors. The pooled analysis across these four studies revealed that taVNS, compared to sham stimulation, significantly increased sAA levels over time. Our preliminary data supports the assumption that taVNS affects the LC-mediated noradrenergic system. This is an ongoing project and more data from different labs will be included with an increased number of variables (e.g., stimulation duration, stimulation intensity) to identify further factors that may modulate the taVNS-induced sAA changes.

EARLY HYPERVIGILANCE AND LATER AVOIDANCE: ERPS TRACK THE PROCESSING OF THREATENING STIMULI IN ANXIETY AND THEIR MODULATION BY AVOIDANCE

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Descriptors: Avoidance Learning, ERPs, Anxiety

Avoidance behavior, a key symptom of anxiety disorders, can be treated with exposure therapy, albeit not always. Previous research suggests to decompose anxiety into two dimensions: anxious apprehension (i.e., worry) and anxious arousal (i.e., physiological hyperarousal). How these two dimensions affect avoidance behavior, exposure, and their interaction, and how they affect the accompanying neural processes is barely understood. Therefore, we collected EEG data from 124 healthy individuals, participating in a two-phase picture-viewing task including neutral and threatening pictures, using a 2 (anxious apprehension: low/high) \(\times\) 2 (anxious arousal: low/high) design. Results showed that during habituation, when instruction was to either avoid or maintain the upcoming emotions during picture presentation, threatening compared to neutral pictures were associated with increased in-depth processing, modulated by instruction (lower during avoidance) and worry (lower for high worry participants). During re-exposure, now always having to maintain the emotions, previously maintained compared to avoided pictures revealed a decreased in-depth processing, indicative of successful habituation. Interestingly, high worry participants showed impaired habituation. Moreover, they also showed increased anticipatory attention to threatening vs. neutral pictures and heightened automatic processing, independent of stimulus type. These results suggest that anxious apprehension vs. anxious arousal affects the neural processing during avoidance, thereby maybe affecting the progress of exposure therapy.

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Poster 2-044

TRAITS ANXIETY AND CONDITIONED RESPONDING: ROLE OF THE US WORK-UP PROCEDURE?

Julia Wendt and Miriam Hufenbach
University of Potsdam

Descriptors: Trait Anxiety, US Work-up, US Intensity

Electro-tactile stimuli are commonly used as unconditioned stimuli (US) in fear conditioning research and their intensity if often set to an individual level, e.g., ‘unpleasant, but not painful’, by way of a US work-up procedure. Here, we aimed to explore a potential mediating role of the shock work-up procedure on the association between trait anxiety and conditioned responding. To that end, we investigated the effects of trait anxiety on final US intensity and heart rate (HR) and skin conductance responses (SCRs) during early US trials as well as conditioned SCR and fear-anxiety on final US intensity and heart rate (HR) and skin conductance responses (SCRs) during late acquisition training across two fear conditioning studies (total N = 201). Using path analysis we have found trait anxiety to be related negatively with US intensity (standardized coefficient = −0.284) and predictive of heightened SCRs to the CS+ during late acquisition (standardized coefficient = 0.168). Moreover, US intensity covaried with initial autonomic responding to the US and both were associated with later conditioned responding. However, indirect effects of trait anxiety on conditioned responding were not significant. Taken together, these results indicate that the relation between trait anxiety and acquisition outcomes is not mediated by US intensity or initial US responding, but highlight the importance to consider effects of individualized US intensities on conditioned responding in fear conditioning research.

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Poster 2-045

LEARNING WORD-OBJECT ASSOCIATIONS VIA IMMEDIATE AND DELAYED FEEDBACK: DOES FEEDBACK PROCESSING PREDICT FREE RECALL PERFORMANCE?

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Descriptors: Feedback Learning, Free Recall, Feedback Delay

In feedback learning, delaying feedback by a few seconds results in a shift from striatum-to hippocampus-based knowledge acquisition, and possibly a shift from procedural to declarative memory. While the event-related potential (ERP) component Feedback-Related Negativity (FRN) presumably reflects striatal activity during feedback processing, a recent study proposed that the N170 reflects feedback-related activity of the hippocampus or adjacent medial temporal lobe (MTL). To investigate the relationship between these components and memory performance, we adapted a word-object-association paradigm with immediate and delayed feedback and added a free recall test in healthy young participants (N = 28). As free recall is selectively enhanced by hippocampus activity during learning, the N170, but not the FRN, was expected to predict free recall performance. We analyzed the data with mixed linear models based on single trials. As hypothesized, we found FRN amplitudes to be modulated by feedback valence only after immediate feedback and no relationship between FRN amplitudes and free recall performance. Contrary to previous studies, we found larger N170 amplitudes for immediate than delayed feedback. However, while the N170 was generally more pronounced on the right hemisphere, the hemisphere difference was larger for remembered items. This shows that the N170 is indeed associated with memory performance. Whether it reflects hippocampal or MTL activity should be further examined with a spatially more precise method such as fMRI in combination with electrophysiology.

Poster 2-046

EEG AND PUPILLOMETRY CORRELATES OF COGNITIVE OVERLOAD

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Descriptors: Working Memory, Pupillometry, EEG

Most previous psychophysiological studies have manipulated verbal working memory load in a narrow range, normally not exceeding 5 items. It is unclear how brain responds to the load exceeding normal capacity limits. The main objective of the current study was to investigate the phenomenon of memory overload by means of EEG and pupillometry. Eighty-six participants were presented with a digit span task with auditory serial presentation of the digits. Each trial consisted of sequences of either five, nine or 13 digits with SOA of 2 seconds. Pupil size reached the peak at the 7-digit load, started declining after presentation of the ninth digit and dropped to the baseline level before the instruction to recall the sequence. Similarly, frontal midline theta power reached the peak at the same 7-digit load and started declining after the ninth digit, though never reached the baseline level. Meanwhile, alpha activity showed a suppression pattern continuing to the last digit in the sequence. We also found significant correlations between average behavioral performance and pupil size, alpha and theta power in the memory condition, which was 0.33, −0.29, and 0.30 (Spearman rho), respectively. Importantly, theta and pupil size also correlated (rho = 0.48, p < .001) but alpha and pupil size did not (rho = −0.13, n.s.). Thus, theta activity and pupil size, after initial rise, expressed a pattern of a decrease with reaching the state of memory overload, whereas alpha activity continued to decrease even after expected cognitive overload.

Funding: Study was supported by Russian Foundation for Basic Research (RFBR) #19-013-00027.
CUE-REACTIVITY TO AFFECTIVE AND SOCIAL MEDIA STIMULI: ASSESSING MOTIVATED ATTENTION IN PROBLEMATIC USERS

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Descriptors: Cue-reactivity, Event-related Potentials, Addictive Behaviors
Similar to addictive behaviors, Problematic Social Media Use (PSMU) seems to be characterized by sensitized reward processing and cue-reactivity. However, mechanisms related to cue-reactivity in PSMU remain to be clarified. We investigated cue-reactivity to Facebook cues in individuals identified as problematic vs. non-problematic Facebook users by the Problematic Facebook Use Scale. The Event-Related Potentials (ERPs) were recorded during the viewing of Facebook-related, pleasant, unpleasant, and neutral pictures in 27 problematic and 26 non-problematic users. Craving for Facebook usage was collected using a Likert scale. The results showed that despite problematic users were more likely to endorse higher craving than non-problematic ones, Facebook cues elicited larger ERP positivity (400–600 ms) than neutral, and comparable to unpleasant stimuli, in all users. Only in problematic users we found larger positivity (600–800 ms) to pleasant than unpleasant cues, and higher craving to be related with lower later positivity (800–1,000 ms) to pleasant and unpleasant cues. Regardless of whether Facebook usage is problematic, Facebook cues seem to be motivationally relevant stimuli that capture attentional resources in the earlier stages of “motivated” attentional allocation. Moreover, our results suggest that in higher-craving problematic users, reduced late emotional processing would be the result of defective emotion regulation processes that allow craving states to capture more motivational resources at the expense of other emotional states.

DEPRESSION AND BLUNTED CARDIOVASCULAR REACTIVITY TO ACUTE PSYCHOLOGICAL STRESS: EARLY LIFE ADVERSITY AS A MODERATOR

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Descriptors: Cardiovascular Reactivity, Depression, Early Life Adversity
Objective: The pathways underlying the depression and cardiovascular reactivity association remain unclear. The current study examined the role of early life adversity on the relationship between depression and cardiovascular reactivity to acute psychological stress. Methods: Moderation analyses were conducted using data from 639 participants drawn from the Midlife Development in the United States (MIDUS II) Biomarker Project. Responses were derived from the Childhood Trauma Questionnaire (CTQ) and Center for Epidemiologic Studies Depression Scale (CES-D). Participants had their systolic and diastolic blood pressure (SBP, DBP) and heart rate (HR) monitored throughout a standardized stress testing protocol. Results: Depression was negatively associated with cardiovascular reactivity to acute psychological stress, β = −.49, t(627) = −2.92, p = .004, 95% CI [−.81, −.16], and for DBP at both moderate levels, β = −.15, t(628) = −2.75, p = .006, 95% CI [−.26, −.04] and high levels of childhood sexual abuse, β = −.25, t(628) = −3.89, p < .001, 95% CI [−.37, −.12]. Conclusions: The present findings extend the depression and cardiovascular reactivity literature and demonstrate that sexual abuse in childhood exacerbates the link between depression and cardiovascular reactivity.

TOWARDS LONGER LASTING EFFECTS: MIDFRONTAL THETA DECREASES DUE TO LOW-INTENSITY TRANSCRANIAL FOCUSED ULTRASOUND PREDICT INCREASED APPROACH BEHAVIOR IN A VIRTUAL T-MAZE TASK

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Descriptors: Low-Intensity Transcranial Focused Ultrasound Neuromodulation, Midfrontal Theta in Association with Behavioral Measures, Comparison of Subjective and Objective Measures
Low-intensity transcranial focused ultrasound (LITFUS) is a relatively new form of non-invasive neuromodulation with high precision for target selection and energy dosage, while avoiding side effects like headaches or skin irritations. Recent reviews highlighted its potential for basic research as well as clinical applications (Beisteiner & Lozano, 2020; Blackmore et al., 2019; Landhuis, 2017). This double-blind within-subjects study (N = 155) utilized LITFUS targeting the right prefrontal cortex, which was found to positively enhance self-reported global mood (Hameroff et al., 2013; Reznik et al., 2020; Sanguinetti et al., 2020). The present study expanded these findings by using more specific self-report, and by adding a virtual T-maze task to measure approach behavior while recording electroencephalographic midfrontal theta (MFT), which has been associated with conflict experiences and behavior (Cohen & Donner, 2013). We hypothesized LITFUS would positively enhance self-reported mood, increase approach behavior and decrease MFT. Although no specific self-report changes were found, LITFUS led to significant MFT decreases, which significantly predicted increases in approach behavior. The LITFUS-induced MFT decreases and approach behavior increases confirmed our hypotheses. The absence of self-report effects might be due to our study’s focus on a task rather than self-reflection. This study expands the evidence for the impact of LITFUS on behavior and physiology, suggesting the promise of further basic and applied research, such as emotional and motivational disorders.

Funding: Alexander von Humboldt Foundation.
Poster 2-052

IS RESTING HEART RATE VARIABILITY ASSOCIATED WITH DEPRESSION AND ALEXITHYMIA? A NETWORK ANALYSIS

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Descriptors: Alexithymia, Heart Rate Variability, Depression

Heart rate variability (HRV) is considered as an objective index of regulated emotional responding. Although, greater scores of HRV are associated with reduced depression and greater alexithymia levels, until now no previous study has examined the relationship between HRV and the different dimensions of the aforementioned disturbances through network analysis. Such analysis can shed light on the composition and topology of HRV and quantify and visualize its complex interactions with dimensions of depression and alexithymia. For this purpose, the resting HRV of 430 college students for five minutes was measured and we estimated low-frequency (LF), high frequency (HF), SDNN, RMSSD and LF_HF HRV. Participants completed also self-report measures of depression and alexithymia. Analysis was performed with EBICGLASSO method. Even though findings showed that the difficulties in identifying feelings dimension of alexithymia was associated with cognitive-affective and somatic symptoms of depression, HRV indices were not connected with neither depression nor alexithymia clusters. Such outcomes support no associations between HRV and alexithymia and depression contrary to previous outcomes. Findings are discussed in relation to theoretical aspects of HRV and its relationship with emotional disturbances and have implications for the application of a novel class of methodological techniques such as Network analysis in the field of psychophysiology to explore systems that present an interdependent structure and their associations with several other systems and constructs.

Funding: The current study received funding from the Internal Grants of the University of Cyprus.

Poster 2-053

EMPATHY AND MACHIAVELLIANISM ARE RELATED TO THE CHARACTERISTIC PATH LENGTH OF RESTING-STATE EEG NETWORK

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Descriptors: Empathy, Connectivity, Resting-state EEG

The association between personality traits related to prosocial behavior and graph metrics of global resting-state EEG network was not previously investigated. The methodology of the present study integrates social and network neuroscience approaches. The study sample comprised 28 participants (18 women), 21.4 ± 2.1 y.o. The procedure included resting-state EEG recordings (19 channels) under eyes closed/opened conditions each for 5 minutes. After the EEG recording participants were asked to fill out questionnaires: Interpersonal Reactivity Index (IRI), Short Dark Triad (SD3), Hexaco-PI-R, Rushton Altruism Scale, Emotion Quotient. Functional connectivity matrices (weighted phase-lag index, wPLI) between reconstructed by sLORETA cortical sources were computed for 3 frequency bands (4–8, 8–13, 13–30 Hz). Connectivity graphs were built using wPLI matrices with the median threshold of weak connections cut-off. Such graph metrics as characteristic path length (CPL), clustering coefficient (CC), modularity, and small world index (SWI) were calculated. Results indicate significant relations between Personal Distress (IRI scale) and CPL in beta-band (eyes closed) (r Spearman = 0.69, p = 0.0218, Holm-Sidak corrected) and between Machiavellianism (SD3 scale) and CPL in theta-band (eyes opened) (r = −0.64, p = 0.0367). These findings suggest low information processing efficiency in case of high Personal Distress and inverse relation in case of high Machiavellianism. Our study reveals new directions for research of network neural mechanisms of individual differences in prosocial behavior.

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Poster 2-054

RUMINATION AND CARDIOVASCULAR HABITUATION TO PSYCHOLOGICAL STRESS

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Descriptors: Rumination, Habitation, Stress

Cardiovascular reactivity to stress is an established marker of lifetime disease risk. Research has started to incorporate a broader characterization of the cardiovascular stress response to include cardiovascular non-habituation – whereby individuals persistently exhibit exaggerated cardiovascular responses on exposure to the same recurring stressor. One factor that is likely to explain why some individuals do not habituate to stress may be rumination or mentally dwelling on a negative situation. Following a resting period, participants (n = 151) completed the same stress task twice separated by an inter-task interval. Data were analysed using 2 × 2 × 2 mixed factorial analysis of covariance, with phase (first stressor, second stressor) as the withinsubject’s factor and trait rumination (high, low) and state rumination (ruminating, not ruminating) as the between-subject’s factors. The dependent variables were SBP, DBP and HR. High and low trait ruminators who did not engage in state rumination successfully adapted to the recurring stressor, with both groups displaying similar heart rate habituation. However, high trait ruminators who engaged in state rumination displayed significantly worse heart rate habituation from the first to the second stress exposure in comparison to their low trait ruminating counterparts. The effect of high trait rumination on cardiovascular habituation to repeated stress differs depending on whether or not those individuals also engage in state rumination.
THE REPEATED MONTREAL IMAGING STRESS TEST (RMIST): TESTING HABITUATION, SENSITIZATION, AND ANTICIPATION EFFECTS TO REPEATED STRESS INDUCTION

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Descriptors: Stress, Physiology, Habituation

A psychosocial task that can induce comparable levels of stress repeatedly is fundamental to effectively study changes in stress reactivity over time or as a result of an intervention. However, existing tasks have struggled to provide consistent responses across repeated trials, with participants showing habituation, sensitization, and anticipation effects. We assessed the efficacy of two designs of the repeated Montreal Imaging Stress Test (rMIST) in reproducing the same pattern of reactivity over two separate sessions one week apart. The first study (N = 53, mean age=24) consisted of a single longer stress exposure, and the second study (N = 30, mean age = 22) of several shorter stress exposures per session. Self-reported (i.e., perceived stress [PS] and negative affect [NA]), and physiological (i.e., heart rate [HR], root mean square of successive differences [RMSSD], and salivary cortisol) measures were assessed. Except for cortisol, all measures responded to stress exposure and reactivity was comparable across sessions. However, baseline HR in the second session increased relative to the first session in the first study. There was also a decrease in HR and RMSSD reactivity within the session on the second study, suggesting a habituation effect not between but within the session. The rMIST overcomes some of the challenges associated with repeated stress induction, albeit an anticipation effect and a lack of cortisol response indicate that further adjustments are necessary. Finally, one stress exposure per session is more appropriate than multiple stress exposures for repeated use.

Funding: FWO Odyssesus grant.

PERFORMANCE MONITORING IN IMPULSIVITY AND COMPULSIVITY

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Descriptors: Performance Monitoring, Compulsivity, Impulsivity

Adaptive behavior is based on monitoring of response outcomes, a process called performance monitoring (PM). Neural correlates of PM, like the error-related negativity (ERN), depend on motivational context and are altered in various mental disorders marked by impulsivity and compulsivity, like obsessive-compulsive disorder (OCD) and substance use disorder. The current study investigated how PM-related brain activity is altered in different configurations of impulsivity and compulsivity and whether these effects are influenced by motivational context. We recorded the ERN in two EEG studies with a classical Flanker task (cFLAT; n = 101) and a monetary incentive Flanker task (MIFLAT; n = 226). Both samples were recruited along the dimensions of impulsivity and compulsivity. In the cFLAT we observed significantly higher ERN amplitudes in the low impulsive/high compulsive compared to the low impulsive/low compulsive individuals. In the MIFLAT, compulsivity, impulsivity as well as the interaction of both significantly predicted ERN amplitude within the gain context. In the loss context, the main effect for impulsivity was significant. The effect of increased ERN amplitude in compulsive individuals is consistent with earlier findings on compulsivity and OCD, and replicates this effect in the cFLAT and the MIFLAT, at least within in the gain context. However, effects of impulsivity varied between tasks and motivational contexts, suggesting that PM in high impulsive individuals is more sensitive to motivational influences.

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MODULATION OF ELECTROPHYSIOLOGICAL CORRELATES OF PERFORMANCE MONITORING IN HEALTHY INDIVIDUALS AND PATIENTS WITH OCD BY TRANSCRANIAL DIRECT CURRENT STIMULATION

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Descriptors: Error Monitoring, Transcranial Direct Current Stimulation, Event-related Potentials

Overactive performance monitoring, as indexed by enhanced electrophysiological correlates of error processing, is discussed as a biomarker for obsessive-compulsive disorder (OCD) and may be a promising target for new treatment approaches. Non-invasive stimulation of the medial frontal cortex (MFC) has been found to modulate neural error signals (error-related negativity, ERN; error positivity, Pe) in healthy participants and has promising potential to reduce OCD symptomatology, but no study has yet investigated its efficacy in modulating performance monitoring in OCD. We conducted a prereregistered, double-blind, sham-controlled, crossover study to investigate the modifiability of event-related potentials (ERPs) of negative affect [NA] and physiological (i.e., heart rate [HR], root mean square of successive differences [RMSSD], and salivary cortisol) measures. Except for cortisol, all measures responded to stress exposure and reactivity was comparable across sessions. However, baseline HR in the second session increased relative to the first session in the first study. There was also a decrease in HR and RMSSD reactivity within the session on the second study, suggesting a habituation effect not between but within the session. The rMIST overcomes some of the challenges associated with repeated stress induction, albeit an anticipation effect and a lack of cortisol response indicate that further adjustments are necessary. Finally, one stress exposure per session is more appropriate than multiple stress exposures for repeated use.

Funding: FWO Odyssesus grant.

AFFECTIVE ACTION EVALUATION AND ITS ASSOCIATION WITH ELECTROPHYSIOLOGICAL CORRELATES OF ERROR MONITORING IN HEALTHY INDIVIDUALS AND PATIENTS WITH OCD

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Descriptors: Affective Processing, Error-related Negativity, Obsessive-compulsive Disorder

Altered performance monitoring, specifically enhanced error monitoring, has been frequently found in obsessive-compulsive disorder (OCD), often apparent in heightened amplitudes of the error-related negativity (ERN). Yet, little is known about how the ERN relates to affective action appraisal. This study aimed to extend prior findings of a relation between ERN and affective action evaluation (i.e., affective labeling of own actions) by investigating affective priming on trial-level in OCD. EEG was recorded while 28 patients with OCD and 28 healthy control (HC) participants performed an affective priming paradigm in which responses in a go/no-go task served as primes for the subsequent affective categorization (positive or negative) of words. Mixed-effects models revealed an affective priming effect in both groups, indicating faster categorization of words when preceded by an action of the same assigned valence (e.g., positive words after errors). Patients with OCD showed a diminished priming effect after errors compared to HC participants. Contrary to our expectations, the priming effect was not related to the ERN amplitude and there was no group difference in this association. We found no evidence that the ERN is linked to the affective evaluation of self-generated actions. In OCD, affective appraisal of errors seems to be hampered, presumably resulting from processes interfering with internal action appraisal (e.g., worry). Altogether, our findings imply that alterations in the affective appraisal of actions may be implicated in altered error monitoring in OCD.
DEPRESSION CAUSES INTRAMODULAR AND GLOBAL HYPERCONNECTIVITY IN RESTING-STATE EEG NETWORKS

Alisa Komarova, Andrey Kiselnikov, Maria Yurlova, Ekaterina Slovenko, Irina Tan, Dina Mitiureva, Polina Kabanova, Evgenia Terlichenko, Veronika Zubko, and Elizaveta Shcherbakova
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Descriptors: Depression, Connectivity, Resting-state EEG

Objective. Recent studies have shown changes in some specific graph characteristics of functional brain connectivity (FC) in depression. In this study we aimed to further investigate an abnormal graph structure in a student sample with depressive symptoms by analyzing resting-state EEG. We tested all possible combinations of graph metrics, frequency bands, and sensors/sources levels of networks. Method. Resting-state EEG was recorded in 14 participants with high Beck Depression Inventory (BDI) score (BDI = 24.4 ± 9.7; mean age = 20.4 ± 1.5; 14 females; 1 left-handed) and 14 participants with low BDI score (BDI = 6.8 ± 3.7; mean age = 21.3 ± 2.0; 8 females; 1 left-handed). We calculated characteristic path length (CPL), clustering coefficient (CC), index of modularity (Q), small-world index (SWI) in sensors- and sources-level FC networks constructed in 4 frequency bands (4–8, 8–13, 13–30, 4–30 Hz) using weighted phase-lag index (wPLI). To study between-group differences in these metrics we applied Mann-Whitney U-test (p < .05).

Results and Discussion. The group comparison showed decreased CPL in the beta-band network and increased CC and Q in the 4–30 Hz band networks (sensors-level for CPL and CC, and sources-level for Q) in the depressed group. Increased CC and Q reflect the rise of intramodular connectivity, as well as decreased CPL is a well-known marker of global connectivity rising (Fornito, Zalesky, Bullmore, 2016). Conclusion. These results suggest that intramodular hyperconnectivity could explain the elevation of global functional connectivity in depression.

Funding: This research has been supported by the Interdisciplinary Scientific and Educational School of Lomonosov Moscow State University ‘Brain, Cognitive Systems, Artificial Intelligence’.

STANDARD TONE STABILITY AS A MANIPULATION OF PRECISION IN THE ODDBALL PARADIGM: MODULATION OF PREDICTION ERROR RESPONSES TO FIXED-PROBABILITY DEVIANTS

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Descriptors: Prediction, Audition, Regularity

Electrophysiological sensory deviance detection signals, such as the mismatch negativity (MMN), have been interpreted from the predictive coding framework as manifestations of prediction error (PE). From a frequentist perspective of the classic oddball paradigm, deviant stimuli are unexpected because of their low probability. However, the amount of PE elicited by a stimulus can be dissociated from its probability of occurrence: when the observer cannot make confident predictions, any event holds little surprise value, no matter how improbable. Here we tested the hypothesis that the magnitude of the MMN elicited to an improbable sound (D) would scale with the precision of the prediction derived from the repetition of another sound (S), by manipulating repetition stability. We recorded the EEG from 20 participants while passively listening to 4 types of isochronous pure tone sequences differing in the probability of the S tone (880Hz) while holding constant the probability of the D tone (1046Hz; p(D) = 1/11): Oddball (p(S) = 10/11); High confidence (7/11); Low confidence (4/11); and Random (1/11). Tones of 9 different frequencies were equiprobably presented as fillers (p(S)+p(D)+p(F) = 1). Using a non-parametric, cluster-based correlation analysis controlling for multiple comparisons, we found that the amplitude of the ERP became more negative with increasing S probability, in a time-electrode window consistent with the MMN (ca. 120–200 ms; frontal), suggesting that the strength of a PE elicited to an improbable event indeed increases with the precision of the predictive model.

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EFFECTS OF ACTION ON EPISODIC MEMORY STRUCTURE AND SOUND SEQUENCE RECALL

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Descriptors: Self-generation, Episodic Memory, Production Effect

Self-generation effects describe attenuated sensory processing for self-generated (SG) stimuli compared to externally generated (EG) ones. In parallel, the production effect suggests that SG stimuli are differentially encoded in memory. However, there has been no direct attempt to relate these two effects. As information encoded in memory is organized into discrete episodes we hypothesized that actions may not only modulate the strength of memories for SG stimuli, but they may additionally structure the encoding of events in memory, creating differentiated memory representations for SG and EG stimuli. We designed a memory task where consecutive SG and EG sounds were delivered at encoding, creating two different context-episodes within a sequence. At retrieval we presented a pair of test-sounds which could be formed either by across-context (SG-EG, EG- SG) or within-context (EG-EG, SG- SG) pair of sounds. Participants answered if the pair was in the correct order or not. Using EEG, we measured self-generation effects on sensory responses to the sounds during encoding and found N1 and P2 attenuation for SG compared to EG sounds. However, despite this differentiated sensory processing, behavioral analyses failed to reveal memory performance differences between across- and within-context pairs. The present findings suggest that the suppression of sensory responses for SG stimuli does not influence memory encoding of these stimuli, pointing to a lack of direct relationship between the known self-generation effects (on sensory processing) and the production effect (on memory).

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“CONTROL” VS “DETECTION” TASKS EFFECT ON THE SEVERITY OF SIMULATOR SICKNESS

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Descriptors: Simulator Sickness, Visual Stimulation, Virtual Reality

Observing a large moving patterns often causes a complex of negative sensations called simulator sickness (SS). The influence of task type (active control of the speed of the flow or passive detection of its changes) on the severity of SS was studied. Each participant (N = 50) completed 2 experimental conditions, identical in visual stimulation, but different in the task type. In both conditions observer was to fixate the central target, which was presented against a moving to the right background of black- and white bars. On top of black- and white bars short thin red bars moved in the same direction. In “control” condition, the speed of the red bars changed periodically and observer was to control by joystick the speed of black- and white bars, equating it to the speed of the red bars. In “detection” condition, participant was to detect braking or acceleration of black-and-white bars pressing the “<” or “>”. Each experimental condition consisted of 3 series (2 min each). Severity of simulator sickness was assessed by several psychophysiological, cognitive, and subjective measures. MANOVA revealed a significant influence of the interaction of Task and Series factors on heart rate (F(3) = 59.089, p = .001), tapping-test (F(3) = 26.970, p = .001), subtractive counting (F(3) = 35.048, p = .001). The results showed that SS increased with time in “detection” in comparison to “control” condition, which was consistent with “Simulator Sickness” questionnaire data. Thus, active control of the speed of the flow in contrast to passive detection of speed change prevents the development of SS.

Funding: This research was supported by Russian Science Foundation Project №19-78-1048.

 ACTIONS DAMPEN SENSORY RESPONSES, INCREASE PUPIL DIAMETER, AND DISRUPT MEMORY ENCODING FOR CONCURRENT, BUT UNPREDICTABLE SOUNDS

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Descriptors: Self-generation Effects, Pupilometry, EEG

Actions modulate sensory processing by attenuating responses to self-generated compared to externally-generated inputs, which is traditionally attributed to specific motor predictions. Yet, suppression has been also found in non-predictive contexts i.e., with mere coincidence between the stimulus and the motor act. This may point to an unspecific gating mechanism, presumably the locus coeruleus norepinephrine system, whose activity can be tracked by measuring the pupil dilation. Meanwhile, it is unknown how the differential processing of self-generated sounds affects their encoding in memory: production effect studies show better memory for predictable self-generated inputs, but predictive coding theories suggest that learning is driven by prediction errors (i.e., worse memory for self-generated stimuli). To assess the specific and unspecific effects of actions on sensory processing and memory encoding of concurrent, but unpredictable sounds, we paired EEG and pupil data during a recognition task: subjects were presented with externally- and self-generated, but unpredictable, sounds at encoding and at retrieval, they responded which one of two test sounds was present before. We found worse memory, attenuated evoked responses, and larger pupil diameter for sounds coinciding with actions compared to the externally-generated ones. Yet, the way the sound was encoded did not affect pupil and evoked responses at retrieval. In sum, specific and unspecific effects of actions seem to coexist and concurrently modulate auditory processing and memory encoding.

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THE OMISSION RESPONSE REFLECTS SPECIFIC AND UNSPECIFIC PREDICTIONS IN ACTION-EFFECT COUPLINGS

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Descriptors: EEG, Predictive Coding, Omission

When a sound is expected to happen but is then unexpectedly omitted, a response to omission can be recorded using EEG. According to recent models of perception, this response is the result of error signalling caused by the prediction of a sound that is not met by any input. Inspired by a forerunner study we investigated the omission response using associations between button presses and sounds: in one condition button presses elicited always the same (“single”) sound, and in the other condition a “random” sound was presented changing after every button press, while in both conditions sounds were occasionally omitted when the button was pressed. Principal component analysis extracted several distinct omission components. In the single sound condition, a nO1, nO2 and multiple oP3 responses were observed, while in the random sound condition a nO1 and multiple oP3 responses were observed. The observed omission component amplitudes were higher in the single compared to the random sound condition. These results suggest that the brain can implement predictions with specific knowledge of what is to come, but also with more general, unspecific knowledge that some sound is about to come. Higher amplitude omission responses in the single sound condition possibly reflect the weight or confidence attributed to the predictions, with higher weight leading to stronger errors. Finally, oP3 responses showed close similarities to various P3 responses normally elicited by stimuli (early-, late-, and novelty-P3a), demonstrating that these responses can be elicited in the absence of stimuli.

Funding: Center for Behavioral Brain Sciences Magdeburg financed by the European Regional Development Fund (ZS/2016/04/78120) and Leibniz Association (P58/2017).
OBSERVER PERSPECTIVE IMPACTS PROCESSING OF AUDITORY CONSEQUENCES OF OBSERVED ACTIONS

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Descriptors: Auditory ERP, Sensory Prediction, Action Observation

Amplitude reductions of the N1 event-related potential component for stimuli caused by one’s own actions are thought to reflect early processing relying on feedforward model predictions of action consequences. Similar predictions seem to be created for observed actions, possibly modulated by the mirror neuron system (MNS), but findings concerning the processing of stimuli produced by observed actions have been ambiguous. Crucially, the effect of the perspective of the observer, which affects the activity of the MNS, has not been investigated so far. We directly tested the influence of observation perspective on the processing of auditory consequences of observed actions by showing 29 participants first and third person perspective recordings of gender matched actors, who produced sounds by button presses. We found N1 amplitude reductions for actor-generated sounds relative to a control condition in which participants listened to external sounds regardless of perspective, suggesting that feedforward predictions likely underlying these reductions are not affected by differing perspectives. Amplitude reductions of the P2 for self-generated sounds seem to rely on contextual information and have been associated with agency attributions for the source of perceived stimuli. In line with this, we found P2 reductions for actor-generated sounds only in the third person perspective which might indicate that in first person, agency attribution processes could be disturbed by the integration of this unnatural viewpoint, despite intact predictions of observed action consequences.

Poster 2-066

CHANGES IN OCULOMOTOR AND BRAIN ACTIVITY INDICATORS DURING VECTION ILLUSION PERCEPTION IN VIRTUAL REALITY

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Lomonosov Moscow State University

Descriptors: Vection, Virtual Reality, Beta-rhythm

Vection is the experience of the sensation of movement of his own body by stationary observer when observing a moving visual stimulus that occupies a significant part of the visual field. The aim of this study was to study the brain mechanisms of vection in virtual reality. We hypothesized that at the moment of the vection appearance, which will be confirmed by changes in oculomotor activity, the power of the beta-rhythm in the parietal region will increase. The experiment involved 11 healthy subjects. The stimulation in the HTC Vive Pro Eye virtual reality helmet was a virtual optokinetic drum that rotated around a vertical axis at velocities of 30, 45, and 60 angular °/s, lasting 2 minutes each. 12 rotations were presented for each subject – 3 speeds × 2 directions (clockwise and counter-clockwise) × 2 repetitions. The task of the subject was to press the button of the manipulator when the illusion appeared. 19-channel electroencephalogram and eye movements were also recorded. The results showed that at the moment of pressing the button, there was a slowdown in the smooth pursuit eye movements and a significant (p < .05) increase in the power of the beta-rhythm in the parietal region in 6 subjects only at the rotation velocity 60 °/s in comparison to other conditions. Also, these subjects rated the severity of the illusion as very noticeable on a 10-point scale. Thus, it was suggested that there were individual differences in brain system of determination the body position and orientation influence on a susceptibility to the appearance of the vection illusion.

Funding: This research was supported by Russian Science Foundation grant №19-78-10148.

POSTER 2-067

LET ME SEE HOW YOU FEEL STORIES: PSYCHOPHYSIOLOGICAL EFFECTS OF DIFFERENT STYLES OF NARRATIONS IN AUDIOBOOKS

Emma Rodero
Pompeu Fabra University

Descriptors: Narration Style, Cognitive Processing, Audiobooks

Audio books are becoming increasingly popular. Edison Research survey found that the average number of audiobooks listened to per year increased to 8.1 in 2020. These data show the relevance of producing quality audiobooks. However, there is a controversial discussion in the industry about the best style of narrating them. Some producers think that narration should be flat not to affect the original book. On the contrary, other professionals defend an interpreted narration reflecting the story's expressivity. With this debate as background, we conducted a study to compare the listeners’ perception, creation of mental images, narrative engagement, physiological response, and recognition when listening to stories conveyed with these two styles. 65 subjects listened to two different stories, two by each type of narration, while we registered their heart rate (ECG), skin conductance (EDA), and facial recognition of emotions. We also performed a recognition test. With significant results in all the variables, the results showed that listeners enjoyed more the stories narrated with an interpreted style than a flat narration. They created more mental images, were more engaged, paid more attention (as showed in lower heart rate levels), had a more intense and positive emotional response (according to EDA and valence results), and remembered more data in the expressive narration. Therefore, the main conclusion is that listeners had better cognitive processing when the style was according to the story. So, a good interpretation in audiobooks can optimize the listening experience.

Funding: BBVA. Leonardo grants.

Poster 2-068: Late-breaking Student Poster

PRE-PANDEMIC AUTONOMIC INFLEXIBILITY PREDICTS PERSEVERATIVE THINKING AND SYMPTOMS OF DEPRESSION IN RESPONSE TO COVID-19-RELATED STRESS

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Descriptors: parasympathetic nervous system, emotion regulation, depression

The parasympathetic nervous system’s ability to flexibly adapt to changes in environmental context is thought to serve as a physiological index of regulatory capacity. The COVID-19 pandemic provided a naturalistic opportunity to test individuals’ capacity to adapt to an unusual set of stressors with broad implications for mental health. In this study, 46 young adults (n=22 with remitted major depressive disorder, n=24 healthy comparison participants) completed a sadness induction paradigm while electrocardiogram and respiration was measured. Autonomic flexibility was indexed via withdrawal of respiratory sinus arrhythmia (RSA) in response to sadness, and RSA augmentation during a recovery period. Pandemic stressors, symptoms of depression, worry, and rumination in response to the pandemic were measured four times across eight weeks, enabling person-centered assessment of stress. Multilevel modeling indicated that individuals with less flexible autonomic recovery from sadness were more likely to experience symptoms of depression and perseverative thinking about the pandemic, when they were exposed to higher levels of pandemic-related stress than usual. The effect for pandemic worry was strongest for individuals with a history of depression. These results suggest that parasympathetic inflexibility confers vulnerability to perseverative thinking and depression in response to pandemic stress. Interventions that improve parasympathetic flexibility might enhance resilience by facilitating adaptability to challenging situations such as those presented by the pandemic.

Funding: This research was supported by grants to Jonathan P. Stange from the National Institute of Mental Health (K23MH112769) and the Brain and Behavior Research Foundation.
ADVERSE PARENTING STYLES ARE ASSOCIATED WITH BLUNTED NEURAL RESPONSES TO SOCIAL FEEDBACK IN ADULTHOOD

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Descriptors: Parenting, Event-related potentials, Social feedback

Parenting can profoundly influence children’s social development, as parents are primary agents in the early socialization process. Deficits in social development, in both childhood and adulthood, are a critical risk factor for adult psychopathology, and a core feature of many internalizing disorders. However, the impact of adverse parenting on neural functioning, which may lead to social dysfunction, and thereby psychopathology, remains unclear. The current study examined whether parenting styles are associated with neural reactivity to the reception of accepting and rejecting feedback from peers, indexed by the P2, an event-related potential (ERP) component that is sensitive to positive feedback. A sample of 388 adults (ages 18 to 58) retrospectively reported their perceptions of maternal and paternal parenting behaviours in childhood. They also completed a computerized peer interaction game involving social acceptance and rejection while continuous electroencephalogram (EEG) was recorded. Results indicate that adverse parenting styles typified by low care and/or high overprotection predicted a reduced P2 to social acceptance, which has been identified as a risk marker for depression. These findings highlight the critical role of parenting in shaping neural reactivity to social feedback beyond childhood. Further research is needed to understand whether the P2 mediates associations between adverse parenting and subsequent depression, and whether early interventions targeting parenting may prevent the lasting impacts of adverse parenting on children’s development.

P300 OF YOUTH AT CLINICAL RISK FOR PSYCHOSIS WITH COMORBID OCD

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Descriptors: psychosis, OCD, P300

Obsessive-compulsive symptoms (OCS) are prevalent among individuals with schizophrenia and are associated with more severe psychosis, poorer cognition, and greater functional impairment. Although OCS may emerge early in the developmental course of schizophrenia, little is known about the neurobiological and clinical features of youth at clinical high risk for psychosis (CHR) who also experience obsessive-compulsive disorder (OCD). While prior studies indicate that the P300 event-related potential (ERP), which reflects attention-mediated information processing, is sensitive to schizophrenia and clinical outcomes among CHR individuals, it is unclear whether P300 is also abnormal in CHR individuals with comorbid OCD. Leveraging data from the North American Prodrome Longitudinal Study, we examined whether symptom profiles and auditory P300 amplitudes differ across individuals at CHR with (OCD+; n=40) and without (OCD−; n=511) OCD and healthy control (HC; n=235) participants. P3b, elicited by infrequent target stimuli, and P3a, elicited by infrequent non-target novel stimuli, were measured during an auditory oddball task. Relative to OCD−, OCD+ CHR youth had more severe psychosis symptoms and poorer prognosis. In contrast to OCD−, which had significantly reduced P3a and P3b amplitudes relative to HC, P300 amplitudes of OCD+ did not differ from HC or OCD−. Together, these results suggest that the clinical and P300 profiles of CHR youth may differ by OCD diagnostic status and that CHR youth with OCD may have distinct mechanisms underling their psychosis risk.

Funding: National Institute of Mental Health grants U01 MH082022, U01 MH081928, U01 MH081902, U01 MH081984, P50 MH066286, U01 MH081988, U01 MH081944, U01 MH076098, U01 MH081857, UL1 TR001863, U01 MH082004 and Department of Veterans Affairs grant IKCX001878.
INDICES OF HEART RATE VARIABILITY SCALE WITH MUSICAL INPUT DURING A VIRTUAL REALITY GAME

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Descriptors: Music, Virtual Reality, Sensorimotor Control

Physical activity is a predictor for health, while music enhances human mood and emotion regulation. Here, we investigated a complex sensorimotor coupling between music and physical activity and its contribution to health, as reflected in HRV. For this, we equipped our participants with an Oculus Rift VR headset and a BIOPAC BioNomadix wireless transducer, for a 2 motor task (active game vs. passive standing) x 2 music (with vs. without musical input) within-participants design. We recorded the continuous electrocardiogram and respiration, for the duration of a song in the VR environment of the game Beat Saber (Imagine Dragons – Whatever it takes). In the game, players stand in a virtual tunnel, where they cut, with the two sabers in their hands, cubes traveling in their direction at various elevations. For each active task, we also recorded participants’ hand distance traveled, the game scores, together with good and bad cuts, and any missed cube for the block of trials. To assess vagal tone, we developed overall indices of heart rate variability, in both the time (e.g., SDNN, RMSSD) and frequency domains (e.g., the HF parameter). Participants’ behavioural performance was significantly higher for the active music task, as compared to the silent condition. As expected, marked HRV was visible under conditions of passive body states, whereas, positive associations between musical input and HRV modulations were detected across active and passive conditions. These results are discussed in the context of current theories of sensorimotor control and music therapy for health.

Funding: This study was supported by a Young Independent Teams grant TE 32/2020, code PN-III-P1-1.1-TE-2019-1699, awarded to GJ by the Romanian Executive Unit for Financing Higher Education, Research, Development and Innovation (UEFISCDI).

MEANINGFUL LINKS FROM THE NUTRITIONAL VALUE OF THE FOOD ON THE PLATE TO ONGOING CARDIAC ACTIVITY

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Descriptors: Food, Heart Rate Variability, Healthy vs. Non-healthy eating

Enhanced variability in consecutive heart beats (i.e., heart rate variability, HRV) has been often linked with appropriate regulation at the cognitive, emotional, and health levels. Because maladaptive eating behaviours link with heart conditions, here we investigate HRV related to the food nutritional value. For this, in a first online experiment, we asked experienced chefs to select photos of well-known world foods, both mains and desserts, high/low caloric. In a second online experiment, we used the selected representative photos within an Implicit Association Test, with the psychological manipulation healthy vs. non-healthy, and the discrimination manipulation high calorific vs. low caloric, in order to assess participants’ attitudes toward the food presented. In Experiment 3, performed in the laboratory, we manipulated the nutritional value of the food (e.g., healthy vs. unhealthy vs. no food, empty plates). We measured the continuous electrocardiogram, together with respiratory activity, while participants watched the food images. They also rated valence and arousal for each food photo. Participants were assessed for classical anthropometric measurements (e.g., weight, height, BMI, fat/muscle mass percentage). As expected, participants were faster to respond to high caloric foods, which they also rate as more arousing. Physiological results highlight positive correlations between the nutritional value of food on the plate and the monitored HRV parameters. These results are considered in the context of current theories of psychophysiological health and eating behaviours.

Funding: This study was supported by a Young Independent Teams project TE 32/2020, code PN-III-P1-1.1-TE-2019-1699, funded by the Romanian Executive Unit for Financing Higher Education, Research, Development and Innovation (UEFISCDI), awarded to GJ by the Romanian Executive Unit for Financing Higher Education, Research, Development and Innovation (UEFISCDI).
ISOMETRIC HANDGRIP EXERCISE IMPROVES WORKING MEMORY REACTION TIMES IN YOUNGER AND OLDER ADULTS

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Descriptors: Isometric Exercise, Physiological Arousal, Working Memory
Physiological arousal affects attention and memory, sometimes enhancing and other times impairing what we attend to and remember. In the present study, we investigated how changes in physiological arousal—induced through short bursts of isometric handgrip exercise—affect working memory performance. A sample of 57 younger (ages 18–29) and 56 older (ages 65–85) participants performed blocks of isometric handgrip exercise in which they periodically squeezed a therapy ball, alternating with blocks of an auditory working memory task. Compared with those who completed a control task instead of handgrip, participants who performed isometric handgrip had faster reaction times on the working memory task. Handgrip-speeded responses were observed for both younger and older adults, across working memory loads. Multimodal physiological responses (heart rate, pupil diameter, and sympathetic tone) indicated that physiological arousal increased during handgrip and subsequently decreased after handgrip. Furthermore, participants with greater increases in physiological arousal during handgrip had faster reaction times on the working memory task. These results suggest that physiological arousal induced through isometric handgrip improves working memory performance. The potential for acute isometric exercise to temporarily improve processing speed may be of particular relevance for older adults who show declines in processing speed and working memory.

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NETWORK INTEGRATION MEDIATES HEART RATE VARIABILITY EFFECTS ON RESTING-STATE BRAIN NETWORK SYSTEM SEGREGATION

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Descriptors: Resting-state Functional Connectivity (rsFC), Integration; Segregation, Heart Rate Variability (HRV)
Resting state (RS) network system segregation is associated with cognitive performance and decreases across the life span with increasing arteriosclerosis (Wig et al., 2017, Kong et al., 2020). Network integration through connector hubs facilitates information flow across segregated systems and is pivotal for cognition (Bertolero et al., 2018). We have shown that heart rate variability (HRV), a measure of cardiovascular reactivity, is significantly associated with segregation in RS networks (Adhimoolam et al., 2020). Here, we hypothesized an association between HRV and network integration, as indexed by the participation coefficient of network nodes. Structural and functional MRI and EEG data were obtained from 46 right-handed participants (22 M/24 F, age: 19–75 years). The MRI dataset underwent processing using fMRIPrep (Esteban et al., 2019) and RS scans were processed with XcpEngine (Ciric et al., 2018). Functional connectivity between brain regions was computed using seeds derived from Power et al. (2011). We computed the segregation and participation coefficients for each network. HRV was computed using frequency-domain methods for different frequency bands. Regression models revealed that HRV significantly (p < .05) predicted network integration in association networks, controlling for age. Mediation analyses revealed that network integration significantly mediated HRV influences on segregation in association and sensory networks. These results provide novel mechanistic insights into the role of HRV in influencing network integration and segregation.

Funding: This work was supported by NIA grant ROIAG059878 to M. Fabiani and G. Gratton.

CUE REACTIVITY AND CRAVING IN BUPRENORPHINE-MAINTAINED OPIATE-DEPENDENT PATIENTS

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Descriptors: Cue Reactivity, Opiate Addiction, Psychophysiological Reactivity
One of the main effective treatments of opioid use disorder (OUD) is an office-based maintenance using buprenorphine. Despite low physical symptoms of withdrawal, treated OUD patients are still vulnerable to relapse. The cue-reactivity test has been among the most useful methods to investigate role of craving and psychophysiological reactions to drug-related items. We recruited fourteen buprenorphine-maintained OUD outpatients. Drug screens were conducted using saliva test and eligibility was confirmed by clinical evaluations. Pictorial cue-reactivity test was conducted using exposure to neutral pictures from the IAPS and drug-related images. The study used blocked design (16 images/block, 3 s per image) with subjective rating of craving. Photopletysmogram, pneumogram, electrodermal and frontal EEG activities were acquired using Nexus-10 to measure skin conductance level (SCL), HRV, respiration rate and evoked EEG responses. Analysis of EEG found higher power of gamma, lower power of theta and changes in theta-gamma coupling in response to drug cues. Autonomic responses were featured by increased SCL, and increased HRV. This response pattern was indicative of increased attention to drug cues as compared to neutral images. Physiological indices of heightened arousal and attention to drug cues are useful objective functional measures to complement subjective reports of craving. Craving and cue-reactivity, and attentional biases are important clinical precipitants of relapse in opioid abusers and their measures may serve as useful objective outcomes of behavioral therapies.

Funding: Prisma Health Transformative Seed Pilot Grant 2021 to Drs Pericot-Valverde, Byrne and Litwin.

NEURAL INDICES OF DRIVER WORKLOAD AND ENGAGEMENT UNDER PARTIAL VEHICLE AUTOMATION

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Descriptors: Applied Psychophysiology, Workload, Visual Engagement
There is colloquial concern that the introduction of automated technology in vehicles may lead to low driver workload and subsequent disengagement from the driving environment. Simulator-based studies have examined the effect of partial vehicle automation on psychophysiological indices of a driver’s cognitive state, but it is unknown how the conclusions translate to on-road driving. Electroencephalographic (EEG) measures of frontal theta and parietal alpha can provide insight into a driver’s mental workload and visual engagement, respectively, while driving. In the current study, we recorded EEG from seventy-one participants while driving on real roadways. We examined two age cohorts (young adults and middle age adults), on two different highway configurations (high-trafficked, straight and low-trafficked, curvy), in four different vehicles (Tesla Model 3, Cadillac CT6, Volvo XC90, and Nissan Rogue), with Level-2 partial vehicle automation both engaged and disengaged. The results showed that there was no statistical difference in mental workload or visual engagement when comparing manual driving and partially automated driving—at least for drivers new to the technology. These findings suggest that the concern surrounding driver disengagement under vehicle automation may need to be tempered. These findings expand our understanding of the effects of vehicle automation on drivers’ cognitive states, as well as demonstrate the utility of employing psychophysiological measures in applied settings like driving.

Funding: This work was supported by NIA grant ROIAG059878 to M. Fabiani and G. Gratton.
CONSIDERATION OF INDIVIDUAL DIFFERENCES IN MOTIVATIONAL ACTIVATIONS IS CRUCIAL FOR THE INTERPRETATION OF P300 AND RT TO PROBE STIMULI DURING AFFECTIVE INFORMATION PROCESSING

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¹Mie University, ²Kwansei Gakuin University

Descriptors: P300, Motivational Activations, Individual Differences

This study attempts to enhance our understanding of P300 amplitude and latency as well as of reaction time (RT) elicited by probe stimuli during affective information processing through individual differences in motivational activations. While it is crucial to correctly understand what each measure indicates, prior studies have shown diverse results. Predictions on the relationship between P300 amplitude and RT vary, depending on which theoretical approach the researchers apply. Besides, P300 and RT have not been well examined through individual differences in approach and avoidance systems. In the present study, therefore, we aimed to examine whether P300 and RT during emotionally manipulated video clips would vary as a function of stimuli emotion and individuals’ motivational activations. To this end, the ERP and RT elicited by electrical probes randomly applied (mean ISI = 10.75 s) to the wrists of 37 college students were measured during 2 min each for 12 video clips (3 from 4 emotional categories: neutral, highly pleasant, highly unpleasant, and highly coactive). Results were largely consistent with arguments of LC4MP (e.g., Lang, 2006). The larger P300 amplitude and longer latency were found among Risk Avoiders during highly unpleasant stimuli, and the opposite tendency (information intake) was found among Risk Takers. RT was found to be influenced by interactions of motivational systems. The results not only enhanced our understanding of human cognition but also indicated whether P300 and RT during emotionally manipulated video clips have not been well examined through individual differences in approach and avoidance systems. This study attempts to enhance our understanding of P300 amplitude and latency as well as of reaction time (RT) elicited by probe stimuli during affective information processing through individual differences in motivational activations. While it is crucial to correctly understand what each measure indicates, prior studies have shown diverse results. Predictions on the relationship between P300 amplitude and RT vary, depending on which theoretical approach the researchers apply. Besides, P300 and RT have not been well examined through individual differences in approach and avoidance systems. In the present study, therefore, we aimed to examine whether P300 and RT during emotionally manipulated video clips would vary as a function of stimuli emotion and individuals’ motivational activations. To this end, the ERP and RT elicited by electrical probes randomly applied (mean ISI = 10.75 s) to the wrists of 37 college students were measured during 2 min each for 12 video clips (3 from 4 emotional categories: neutral, highly pleasant, highly unpleasant, and highly coactive). Results were largely consistent with arguments of LC4MP (e.g., Lang, 2006). The larger P300 amplitude and longer latency were found among Risk Avoiders during highly unpleasant stimuli, and the opposite tendency (information intake) was found among Risk Takers. RT was found to be influenced by interactions of motivational systems. The results not only enhanced our understanding of human cognition but also indicated that precise interpretations of P300 and RT would require considerations of the systems.

Funding: Grant-in-Aid for Scientific Research (C) 26380996.

USING RETROSPECTIVE SELF-REPORT RATINGS TO PREDICT PHYSIOLOGICAL RESPONSES TO POPULAR MUSIC

Robert Potter and Yuqian Ni  
Indiana University, Bloomington

Descriptors: ECG, EDA, EMG

This study examines whether self-reported ratings of popular music collected after a 40-min listening session predict physiological responses during prior exposure. Subjects (N = 33) participated in an experiment where they could do a variety of activities (e.g., study, surf the web, etc.) while listening to radio through headphones. ECG, EDA, and EMG were collected during the listening session. Afterwards, subjects heard 15-s hooks from each song, and rated them for positivity, negativity, arousal, familiarity, and liking. Multilevel modeling was used to analyze the first 60-s of cleaned physiological data, time-locked to each song. Consistent with prediction, songs with higher ratings of liking, arousal, and familiarity elicited greater cardiac deceleration than those with the lower ratings. Also, as predicted, higher skin conductance levels (SCL) occurred during songs later rated higher in liking, arousal, positivity, and negativity. Contrary to prediction, cardiac deceleration was not greater for the songs rated as more positive compared to those rated as less positive. Also, SCL did not differ significantly by familiarity ratings. Most unexpectedly, corrugator activity increased as ratings for liking and positivity increased, yet corrugator was less activated as negativity ratings increased. Overall, experienced physiological responses during music listening seem to contribute to explicit attitudes subsequently reported toward songs, although replication is warranted as is further investigation of EMG responses during music consumption.

SOUNDS DISAMBIGUATING SEQUENCE LENGTH PRODUCE A DISTINCT CORTICAL SIGNATURE: EVIDENCE FROM INDEPENDENT COMPONENT ANALYSIS (ICA) OF EVENT-RELATED POTENTIALS

Amour Simal and Pierre Jolicouer  
University of Montreal

Descriptors: Auditory, Predictive processes

Rapid, pre-attentive prediction, coding of prediction error, and disambiguation of stimuli is an important aspect of processing in the auditory domain. Many studies have observed brain activity in response to a sound matching or mismatching a prediction or expectation. Here we focus on the cerebral responses to sounds that disambiguate the hearing context. Contextual regularities were created by using three possible sequence lengths (1, 3, or 5 tones) in an auditory memory task. When sequence length was not already known, by presenting the load conditions randomly (vs blocking them), and only for the first sequence presentation, the presentation of a 2nd or 4th tone provided disambiguating information allowing one to predict that at least one more tone would follow. ERPs for the disambiguating tones showed an increase in N1 amplitude as well as a larger positivity in the P2/P3a timeframe compared with other tones. To understand better the dynamics underlying these ERP modulations and to differentiate between a P2 and a possible P3a, we subjected the ERPs to ICA. The results revealed several components sensitive to sequence length disambiguation suggesting the involvement of multiple cortical generators, including an activation at temporal electrodes (that was unlikely to reflect P3a). These results suggest a rapid dynamic adaptation of auditory cortical responses related to contextually-determined disambiguating information on a very short timescale, and highlight the usefulness of ICA to tease apart spatially and temporally overlapping ERPs.

Funding: The research was supported by grants from the Natural Sciences and Engineering Research Council of Canada, the Canada Research Chairs program, and the Canada Foundation for Innovation awarded to PJ.
A WINDOW INTO THE RATIONAL MIND: FRONTAL THETA POWER REFLECTS RATIONALITY IN A CLASSIC REASONING TASK

Chad Williams, Folkert Van Oerschot, and Olave Krigolson
University of Victoria

Descriptors: Reasoning, Theta, Cognitive Control
Reasoning is an art that often fails us. We all, on occasion, have acted instinctively and ended up kicking ourselves in hindsight for making faulty judgments. To save ourselves from poor decision making and potential embarrassment, should we abandon intuitive thinking in favour of rationality? Of course not—a balance between intuitive and rational reasoning is necessary for optimal decision making. Our understanding of intuitive and rational reasoning mostly stems from a large body of behavioural research focused on the resolution of word problems. For example, Shane Frederick’s classic widget problem: “It takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets?” Here, we partner neuroimaging with a classical reasoning problem and demonstrate that we can peer into the rational mind using electroencephalography. Our findings demonstrate a strong association between frontal theta neural oscillations and a person’s rationality. Moreover, as slow wave oscillations such as theta imply long-range communication across the brain, our results indicate that rational reasoning requires a diverse whole-brain network in comparison to intuitive reasoning.

Funding: Natural Sciences and Engineering Research Council.

EVENT-RELATED POTENTIAL CORRELATES OF REWARD PROCESSING IN CHILDHOOD LEUKEMIA SURVIVORS

Mei-Heng Lin1, Sally Cole1, Peter Cole1,2, Miriam Rosenberg-Lee1, and Travis Baker1
1 Rutgers University, 2 Rutgers Cancer Institute of New Jersey

Descriptors: Reward Positivity, T-maze Task, Childhood Leukemia Survivors
40%–70% of childhood leukemia survivors (CLSs) exhibit deficits in several domains of cognitive function (e.g., attention, working memory, and information processing speed), which are believed to be caused by the neurotoxicity of the treatment. However, previous studies routinely use traditional neuropsychological test batteries, which are insufficient to explain the specific pathophysiology responsible for the observed cognitive deficits. Here, we examined an electrophysiological biomarker (i.e., reward positivity; RewP) associated with the reward function of the anterior midcingulate cortex, a brain region strongly implicated in cognitive control and learning. The RewP and other event-related potential (ERP) components (e.g., N1, P2, N2, and P3) were recorded from subjects aged 6–17 years while they navigated a virtual T-maze to find rewards. The RewP was computed as the difference wave between ERPs evoked by no-reward and reward feedback at FCz. In line with the literature, our results from 24 neurotypical controls showed a RewP amplitude (~5.04 ± 3.54 μV), significantly different from 0 (p < .001) and will serve as a baseline to compare to the CLS group. Due to COVID-19 restrictions, here we present data from one CLS subject, finding a smaller RewP amplitude (~4.15 μV) than the neurotypical controls. We will present results with a larger sample size as we are actively collecting data from the CLS group. The findings are expected to provide key insights into the effect of chemotherapy-related neurotoxicity on neurocognitive functioning in CLSs.

Funding: Rutgers University Brain and Health Institute; New Jersey Commission on Cancer Research.

COGNITIVE EFFORT EXERTION ENHANCES ELECTROPHYSIOLOGICAL RESPONSES TO REWARDING OUTCOMES

Mario Bogdanov, Hélène Renault, Sophia LoParco, Anna Weinberg, and A. Ross Otto
McGill University

Descriptors: Cognitive Effort, RewP, Reward Processing
A body of recent work has examined many of the neural mechanisms underlying cognitive effort-related discounting of anticipated rewards. However, studies investigating whether prior effort exertion increases or decreases the subjective value of obtained rewards have reported inconsistent findings. Here, we provide a more nuanced account of how cognitive effort affects subsequent reward processing in a novel task designed to assess effort-induced modulations of the Reward Positivity (RewP), an event-related potential characterized by larger responses to monetary gains than to losses. To probe individual differences, we also measured participants’ effort discounting rates and RewP responses in absence of effort manipulations. We found that RewP amplitudes for both gains and losses were significantly elevated in trials requiring more versus less cognitive effort, suggesting that people ascribed more value to high-effort outcomes. Time-frequency analysis revealed that these effects were mirrored in delta band activity, but not in theta band activity. Examining individual differences, we found that participants who are more tolerant of cognitive effort exertion did not exhibit the canonical gain/loss difference in the delta band after low effort exertion, possibly suggesting that these participants experience reward received from easy tasks as less valuable. Together, our findings provide evidence that cognitive effort exertion can increase the subjective value of subsequent outcomes and further suggest that individual differences in effort sensitivity may modulate this effect.

DOPAMINE AND ADAPTATION AFTER ERRORS: INVESTIGATING THE ROLE OF DOPAMINE POLYMORPHISMS IN ERROR-RELATED COGNITIVE CONTROL

Courtney Louis and Jason Moser
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Descriptors: Dopamine, ERN, Women’s Health
Several lines of inquiry suggest that dopamine (DA) functioning contributes to the generation of the error-related negativity (ERN). To date, few studies have investigated the impact of DA polymorphisms on the ERN magnitude, and none have examined whether the association between the ERN and post-error behavior is moderated by DA polymorphisms. The present study addressed this by investigating whether the catechol-O-methyltransferase gene (COMT) and D2 dopamine receptor gene (DRD2) impact the ERN magnitude, and whether they moderate the association between the ERN and post-error behavior. COMT is associated with goal stability, whereas DRD2 is implicated in task switching and flexibility. In line with previous work, we predicted DRD2 would differentially impact the ERN and performance due to its association with cognitive flexibility. The sample consisted of 92 female participants who completed a Flanker task across four time-points and provided saliva samples from which DA polymorphisms were extracted. The results revealed a trending effect for the DRD2 gene in the expected direction, such that those with the polymorphism that translates to more DA in the striatum had a larger ERN. Interestingly, there was also a significant interaction between DRD2 and ERN to predict post-error accuracy (PEA), revealing that for those with less striatal DA, a larger ERN predicted higher PEA. There were no significant COMT gene effects, however. These results imply that the functional role of the ERN in behavior adjustments could be dependent on striatum dopamine levels, and not PFC levels.

Funding: Project # 1R01MH108511-01; “Cognitive Control in Anxiety: The Role of Ovarian Hormones” PI: Jason Moser.
AFFECTIVE TOUCH AND PHYSIOLOGICAL SYNCHRONY IN ROMANTIC COUPLES: THE ROLE OF ROMANTIC ATTACHMENT AND CAREGIVING

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1University of Ottawa, 2Université du Québec en Outaouais, 3Institut du Savoir Montfort

Descriptors: Physiological Synchrony, Attachment, Chronic Pain

Affectionate touch promotes physiological synchrony in couples, which has been linked with empathy and well-being. Yet in couples in which one partner has chronic pain, touch may not always be comforting or easy to provide, suggesting that physiological synchrony may not always occur in the context of touch, or confer benefits if it does. Attachment-related processes may shape the association between romantic touch and physiological synchrony in these couples. In this study, electrodermal activity was recorded in six couples while they watched a video on chronic pain and alternated every 2.5 min between holding and not holding each other’s hand. Physiological synchrony during the touch and no-touch condition was examined as a function of romantic attachment and caregiving. In the two couples demonstrating lower physiological synchrony during the touch (vs. no touch) condition, one or both partners reported high attachment anxiety and avoidance, and the support-provider reported more distant and/or insensitive caregiving. In two of the four couples demonstrating higher physiological synchrony during the touch (vs. no touch) condition, one or both partners reported low attachment anxiety, and the support-provider reported more controlling and/or compulsive caregiving. For the other two couples, both partners reported low attachment insecurity, as well as optimal caregiving. Findings, discussed in light of implications for theory and practice, suggest that the security of the couple may promote physiological synchrony during affective touch that is related to well-being.

PERCEIVED ROMANTIC RELATIONSHIP THREAT DECREASES ERROR SALIENCE

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1University of Mary Washington, 2University of Delaware

Descriptors: Romantic Relationships, EEG, Error-related Negativity

Romantic relationship threats are defined as anything that confers risk to the quality or existence of a relationship, including the presence of other appealing potential partners. The perception of these threats can have significant impacts on psychological and behavioral functioning, although little is known about the impact of perceived relationship threat on sensitivity to error commission—a response which serves, in part, to guide behavior away from maladaptive or risky choices that might exacerbate the threat to the individual or relationship. The present study aimed to fill this gap by using electrophysiological brain activity to examine the link between perceived romantic relationship threat, indexed via experimentally-manipulated state jealousy, and reactivity to making mistakes. Findings indicated that, when faced with a threat to their romantic relationships, individuals care less about making mistakes, evidenced by decreased error-related negativity (ERN) amplitudes. These results highlight decreased error salience as a potential mechanism by which feelings of jealousy lead to engagement in maladaptive, relationship-damaging behaviors.

CONTACT COMFORT IN WOMEN WITH CHRONIC PAIN: LESSONS LEARNED FROM A PSYCHOPHYSIOLOGICAL EXPERIMENT WITH COUPLES

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1University of Ottawa, 2Institut du savoir Montfort, 3Université du Québec en Outaouais

Descriptors: Psychophysiological Measures, Methodological Innovation, Contact Comfort

We present the challenges and opportunities for methodological innovation arising from the testing of an experimental paradigm in which we sought to examine the impact of romantic contact comfort in a stressful situation for individuals with chronic pain, a health condition that has an enormous effect on people’s quality of life. Using a single-case experimental design, this study compared within-subject psychophysiological changes across conditions. During the experiment, the three female participants (31, 37 and 50 years old) watched a stressful video on chronic pain and a neutral video. During each video, their male romantic partner alternated between waiting in a separate room and being present while holding their hand in silence. Psychophysiological data (skin conductance levels) were recorded during the task. Factorial analyses revealed that participants were either significantly less activated during the stressful video than they were during the neutral video, or there was no significant difference in activation between the videos. Results showed that our experimental design needed to be revised for both videos to ensure that one induces a constant stress and that the other is neutral according to the needs of our population. We outline the challenges experienced while testing this novel experiment and discuss recommendations for further development. The insights provided by this study helped to design a new experiment, which enabled a better understanding of the effects of partner involvement for the management of chronic pain.

Funding: Institut du savoir Montfort.

DIVERSIFYING PARTICIPATION: THE RARITY OF REPORTING RACIAL DEMOGRAPHICS IN NEUROIMAGING RESEARCH

Madeline Goldfarb and Darin Brown
Pitzer College

Descriptors: Neuroimaging, Diversity, Participant Recruitment

Functional neuroimaging has been instrumental to the field of cognitive neuroscience; however, its increasing prevalence has evoked conversations concerning limitations associated with reproducibility and bias. Prevailing racial, cultural, and socioeconomic biases in scientific research perpetuate demographic homogeneity in participation, contributing to failed replicability and generalizability and driving inaccurate representations of neurological normalcy. Systematic and exploratory search methods were employed to investigate ongoing practices surrounding participant recruitment and documentation. The search methods exposed a dearth in the reporting of race and ethnicity demographics of participants in neuroimaging research and suggest a degree of homogeneity across participant cohorts. These results drive our recommendations for increased transparency and diversity surrounding research participation.
Cross-Validated Simultaneous Component Analysis for Identifying Individual and Group Differences in Latent Brain Networks

Matthew Snodgrass and Nathaniel Helwig
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Descriptors: ERP, Tensor Models, Functional Connectivity

Neuroimaging data are complex and contain multiple modes of variation—including multiple subjects, spatial locations, and time points. Component models are often employed to generate a parsimonious picture of neuroimaging data and to find latent brain networks. Both Principal Component Analysis (PCA) and Independent Component Analysis (ICA) are frequently used to find components that reflect underlying latent brain networks. For data with multiple subjects, tensor ICA or group ICA can be used for simultaneous component estimation (i.e., pooling all subjects for estimation). In this work, we discuss why these multi-subject approaches are not ideal for identifying latent brain networks that cross-validate to new samples of data. We show how real-world component time courses contain heterogeneity that (a) tensor ICA is too rigid to identify and (b) group ICA is too flexible to identify uniquely. As an alternative, we demonstrate how a hierarchy of simultaneous component analysis (SCA) models can adequately capture heterogeneity for multi-subject component analysis. In particular, we discuss how Parafac2 (a variant of SCA) models heterogeneity and uniquely identifies latent brain networks. Using cross-validation methods with both real and simulated data examples, we highlight the benefits of this approach for identifying individual and group differences in brain networks.

Funding: Snodgrass, M.A. was supported by a fellowship from the Graduate Research Partnership Program in the Department of Psychology at the University of Minnesota, Twin Cities. Helwig N.E. was supported by NIH grants IU01MH108150-01A1 and IR01MH112583-01A1 and a Single Semester Leave award from the College of Liberal Arts at the University of Minnesota, Twin Cities.

Developmental Changes in the Relationship Between Self-Monitoring and External Feedback Processing—An ERP Study

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MGH Institute of Health Professions

Descriptors: Feedback-processing, Error Monitoring, Executive Function

Self-monitoring, in the form of internal error processing, has been reported to be underdeveloped in young children which may lead them to be more reliant on external feedback to facilitate learning. It is hypothesized that the maturation of the executive control system reduces reliance on external feedback and increases internal error processing. The aim of the study was to evaluate developmental changes in the relationship between self-monitoring and feedback processing in children. In the present longitudinal study, 40 children (8–10 years at recruitment) completed a variation of the Eriksen’s flanker task while their electroencephalogram was recorded every year, over three years. Participants were tasked with identifying the direction of a central arrow in a five-arrow array and received performance feedback after each response. EEG was time-locked to: (1) correct and incorrect responses to evaluate the error-related negativity (ERN) as a measure of self-monitoring, and (2) positive and negative feedback to evaluate the feedback-related negativity (FRN) as a measure of external feedback processing. We found an increase in ERN and a decrease in FRN amplitudes with age, consistent with our hypotheses and previous reports. The results indicate an interaction between self-monitoring and feedback processing with a gradual increase in self-monitoring reflecting a maturation of the executive control system. These findings have important implications for understanding the shifts in learning strategies at different ages linked to cognitive development.

Funding: This material was based upon work supported by the National Science Foundation under Grant #1650835 awarded to Yael Arbel.

Event-Related Changes in 1/f-Like Activity in the Power Spectrum of Human EEG

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Descriptors: Aperiodic Activity, Oscillations, Event-related Potentials

An important contributor to the human EEG spectrum is 1/f-like activity in the frequency domain, i.e., power decreases as a function of frequency following a power law. Although long considered noise, recent studies have found systematic differences in 1/f activity between and within individuals, suggesting that non-repeating, aperiodic activity captured by the 1/f scaling of the power spectrum has functional significance in the brain. In the present study, we investigated stimulus-induced, event-related changes in the parameters of 1/f activity in an auditory oddball task, using scalp-recorded EEG. We found that the offset of 1/f power increases immediately following the onset of the auditory stimulus compared to the time window immediately preceding stimulus onset. This in large part, be accounted for by stimulus-locked event-related potentials (ERP), which also have a roughly 1/f-like power spectrum. We also demonstrate that in our sample, event-related changes in the spectral composition of neural activity are only periodic in the alpha band (8-12 Hz), but are non-repeating (non-oscillatory) in most other frequency bands (e.g., theta, 4-8 Hz). Thus, our findings underpin the importance of aperiodic, non-repeating neural activity in the cognitive processing of simple stimuli. Our results also have methodological as well as theoretical implications, because the assumption that 1/f activity remains relatively stable across an epoch is central in baseline correction procedures used in time-frequency domain analyses of neural activity.

Funding: This work was supported by NIA grant RF1AG062666 to G. Gratton and M. Fabiani.

Atypical Functional Network Topology Emerges During Reward Processing in Children with High Levels of Specific ADHD Indicators

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Descriptors: Graph Theory, Dimensional Psychopathology, ADHD

Functional brain networks demonstrate small-world properties (i.e., sub-networks characterized by short path lengths and high clustering among nodes), which contribute to the efficient transfer of information in the brain. However, prior studies show that these typical network properties deviate in individuals with psychopathology. Using a large sample of children ages 9 to 10 years from the ABCD Study, we evaluated four dimensions of psychopathology—general psychopathology, internalizing, conduct problems, and ADHD—and their association with small-world attributes of functional networks via structural equation modeling. Graph theory metrics characterized whole-brain functional network topology during a monetary incentive delay (MID) fMRI task. Most notably, the specific factor of ADHD was associated with: (1) decreased small-worldness in the frontoparietal network (p = .032); (2) longer average path lengths in the subcortical cerebellar (p = .046), medial frontal (p = .046), default mode (p = .04), and visual (p = .04) networks; and (3) decreased local efficiency in the subcortical cerebellar (p = .008), medial frontal (p = .008), and visual (p = .008) networks. These findings suggest that atypical functional network topology emerges during demands related to reward learning and anticipation, and that these network-level attributes are related to ADHD psychopathology. Overall, this suggests a profile of reduced network efficiency among children who endorse ADHD symptoms.

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**Poster 3-020**

**ACUTE STRESS MODULATION OF THE HPA-AXIS AND LPP AMPLITUDE TO CANNABIS CUES IN INDIVIDUALS WITH CANNABIS USE DISORDER**

Thomas Preston and Richard Macatee  
Auburn University

**Descriptors:** Cannabis, Cortisol, LPP  
Disordered cannabis use is expected to increase in light of nationwide legalization efforts. Similar to other drugs, chronic cannabis use is thought to dysregulate the hypothalamic-pituitary-adrenocortical (HPA) axis and enhance the incentive salience of cannabis-related cues. Further, prominent theories of addiction suggest that entainment of these processes occurs as disordered use develops, but this has rarely been tested in humans. To test the expected positive association between stress-induced cortisol and cannabis cue reactivity in Cannabis Use Disorder (CUD), we recruited regular cannabis users ($N = 98$) varying in CUD severity. Participants completed a cannabis cue reactivity task before and after a laboratory stress induction during electroencephalography (EEG) recording, and saliva samples were collected throughout the paradigm. Cannabis cue reactivity was measured using the late positive potential (LPP)—a frontal-central slow wave that occurs approximately 400 ms after stimulus onset—to cannabis-related relative to neutral pictures. Consistent with prior findings, greater CUD severity was associated with reduced stress-induced cortisol reactivity ($t = -2.07, p = .04$). In line with our hypothesis, stress-induced cortisol and cannabis cue reactivity were positively associated in moderate-to-severe CUD ($t = 2.01, p < .05$). Taken together, these results suggest that CUD is associated with dysregulated HPA-axis responding to stress and its entrainment to subsequent cannabis cue reactivity, consistent with prominent theories of addiction.

**Poster 3-021**

**CANNABIS USE FREQUENCY AND CANNABIS CUE MODULATION OF THE LPP**

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Auburn University

**Descriptors:** Cannabis Use, LPP, Psychophysiology  
In recent decades, the prevalence of cannabis use disorder (CUD) has doubled nationwide. Accumulating evidence suggests that enhanced cannabis cue reactivity may be associated with greater CUD severity. A recent study showed that acute stress-elicited enhancement of cannabis cue reactivity, indexed by the Late Positive Potential (LPP), was associated with greater CUD severity. However, it is unclear whether overall cannabis use frequency, regardless of CUD symptoms, is also associated with an enhanced LPP to cannabis cues in a stressful context. 102 regular cannabis users completed a timeline follow-back to assess the number of cannabis use occasions in the past month. The LPP to cannabis relative to neutral images was used to assess cannabis cue reactivity before and after the Mannheim Multicomponent Stress Test, a validated laboratory stressor. The LPP was quantified as the mean amplitude from 400 to 3,000 ms after picture presentation, and cannabis cue reactivity was specifically computed by subtracting the mean amplitude to neutral pictures from the mean amplitude to cannabis pictures. Controlling for the pre-stressor cannabis cue LPP, past-month cannabis use occasions positively predicted post-stressor cannabis cue LPP ($r(93) = 2.08, p = .04$). As hypothesized, individuals who used cannabis more frequently in the past month also demonstrated greater cannabis cue reactivity in the context of stress, as indexed by the LPP. Consistent with our hypothesis, recent heavy cannabis use was associated with greater cannabis cue reactivity in the context of stress.

**Poster 3-022**

**WHAT BASELINE CORRECTION INTERVAL IS OPTIMAL FOR ERP DATA ANALYSIS?**

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**Descriptors:** EEG/ERP, Baseline Correction  
Baseline correction is an important step in event-related potential (ERP) data processing that mitigates the impact of overall voltage offset and gradual drift in EEG signals over time. Typically, baseline correction is performed by calculating the mean voltage during a specific time window, such as the time period immediately prior to the onset of the stimulus, and subtracting that mean voltage value from the entire waveform. Thus, all ERP measurements are heavily influenced by the baseline period, making the selection of baseline correction interval an important part of the data analysis process that may impact the ultimate results of a study. However, despite the importance of this analysis step, baseline correction intervals are typically chosen on the basis of anecdotal evidence or what was used in previous studies, and there has been relatively little systematic evaluation of the impact of different baseline intervals on data quality and statistical power. The aim of the current study was therefore to systematically evaluate the impact of a broad range of baseline intervals on data quality, quantified as the standard measurement error (SME), and statistical power for detecting an experimental effect for a variety of stimulus- and response-locked ERP components: the ERN, LPP, MMN, N2pc, N70, N400, and P3. Results will shed light on the impact of baseline correction on the precision of ERP measurements. Practical guidelines will be provided to help researchers determine the optimal interval for baseline correction in ERP studies.

**Poster 3-023**

**MOTHER-INFANT CONVERGENCE OF EVENT-RELATED POTENTIALS RELATED TO MOTIVATED ATTENTION**

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Purdue University

**Descriptors:** Event-related Potential, Emotion, Mother-infant  
Prior work has provided conceptual support for developmental changes in face and object processing, such that motivated attention, as captured by the negative central (Nc) in infancy, may develop into the late positive potential (LPP) in adulthood. The present study examined these event-related potentials in 12-month-old infants and their mothers ($N = 33$ dyads). Dyads completed a viewing task consisting of familiar and novel face and toy stimuli while electroencephalography was recorded. Analyses examined within-person differences, split-half reliability, and intergenerational associations. Traditional and exploratory Nc measurement procedures were used to refine the estimate of mother-infant convergence. Results suggest that for mothers, the LPP was largest for familiar faces ($F(1, 30) = 11.17, p = .002$; $F(1, 30) = 26.52, p < .001$). In infants, the Nc did not vary by condition (all $p > .05$). However, intergenerational associations were strong between the LPP and Nc, particularly when electrode and time window were taken into account ($r$ range $= .25$–.55). The LPP demonstrated fair reliability across conditions ($r_{50} = .77$); reliability of the Nc was lower and was influenced by looking behavior ($r_{50} = .44$). Refinement of data handling and ERP scoring procedures for infant ERPs are crucial next steps for estimation of intergenerational associations and further examination of developmental changes in face and object processing.

**Funding:** This project was supported by internal funding provided by Purdue University (to DF and BK).
EVALUATING THE FEASIBILITY OF DETECTING STRESS USING DEEP LEARNING WITH WEARABLE AND SELF-REPORT MEASURES

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Descriptors: Stress Detection, Deep Learning, Wearable Measurements

Americans experience stress daily. Stress encompasses physiological and behavioral reactions in response to threatening situations. Wearable technology has become attractive methods to automatically detect stress using features from physiological signals. However, the accuracy of these methods is affected outside of laboratory settings due to poor data quality. In this study, we propose a mix approach by combining physiological data, and self-ratings of stress with deep learning models to detect stress. We hypothesize that the use of subjective data can help ground-truth stressful situations and lead to better stress identification tools. Eighteen participants underwent the Trier Social Stress Test (TSST), a validated stress induction method, at the Well Living Lab. Electrodermal activity, skin temperature, heart rate, as well as subjective stress and anxiety ratings were collected throughout the study. Salivary cortisol was also measured to verify participants were stressed during the TSST. We used simple and complex classifiers to distinguish between stress and non-stress periods based on the TSST timings. The model was able to detect stress periods with 96% accuracy, 74% sensitivity, and 99% specificity with the combined wearable data alone (88%, 24%, and 98%, respectively). Creating multi-dimensional datasets could help correlate stress-inducing events with feelings of stress at the individual level and help reduce the intra-individual variabilities due to the subjective nature of the stress response.

SPINAL FLEXION EFFECTS ON COGNITIVE AND EMOTIONAL PROCESSING DURING VIDEO VIEWING

Jingjing Han1, Lucia Cores-Sarría2, Jessica Myrick3, and Robert Potter2
1Fudan University, 2Indiana University, Bloomington, 3Pennsylvania State University

Descriptors: Mobile Devices, Tech Neck, Posture

Mobile media devices have changed our traditional video viewing experiences in multiple ways. One prominent change is that when viewing content on these devices, humans often hold them so their head points down at the screen, rather than looking straight ahead with eyes forward. In this study, we investigated how such changes in spinal flexion alters viewers' cognitive and emotional processing of video messages. The experiment (N = 87) used a 2 (neck posture: neutral vs. flexion) × 2 (video valence: positive vs. negative) × 2 (arousing content: calm vs. arousing) × 2 (video topic) mixed-design. Neck posture was a between-subjects factor and all other message variables were within-subjects factors. During video viewing, ECG, EDA, and corrugator facial EMG were measured. Multilevel modeling results showed that neck flexion led to increased EDA over time for both negative and positive videos but neutral neck postures resulted in a slight decrease in EDA. Similarly, the neck flexion posture led to a significantly higher EDA for calm (but not arousing) videos. The neck flexion posture also elicited significantly lower corrugator muscle activity than the neutral neck posture, when videos were either arousing or negative. Results showed no significant differences in neck posture for heart rate data. This study suggests that the neck flexion posture impacted the emotional more than the cognitive components of message processing, partially supporting the idea that posture functions as a self-regulating process for the purpose of survival and well-being.

Funding: Support for this research came from the Office of the Vice Provost for Research, Indiana University.

BREATHING FREQUENCY IMPACTS MOVEMENT INITIATION UNDER EMOTIONAL CONTEXTS VIA PERCEIVED CHANGES IN DYSPNEA AND HINDRANCE

Taylor Buchanan and Christopher Janelle
University of Florida

Descriptors: Breathing, Reaction Time, Dyspnea

Arousal, attention, dyspnea, and hindrance can mediate the impact of breathing frequency on motor behavior in neutral contexts. Herein, we sought to determine whether such mediation effects occur when performing a memory guided force pulse under varying emotional conditions. Thirty-five participants (mean age 22) performed slow, normal, and fast metronome-paced breathing while viewing pleasant and unpleasant stimuli prior to executing a pinch grip task. Performance was assessed via reaction time (RT), variability (CVf) and error (RMSE). Heart rate variability (HRV) and a visual analog scale (VAS) were used to assess arousal. VAS assessed attention, dyspnea, and hindrance. Results showed slow breathing increased RT and HRV compared to normal and fast breathing. In addition, decreased breathing frequency predicted increases in RT under pleasant conditions, while predicting increases in HRV for unpleasant conditions. Increases in dyspnea and hindrance predicted increases in RT for pleasant conditions, while only increases in hindrance predicted increases in RT for unpleasant conditions. Decreases in breathing frequency predicted increases in HRV while viewing unpleasant images. Collectively, these data support our hypothesis that attention, dyspnea, and hindrance mediate the impact of breathing frequency on motor behavior under varying emotional contexts. Implications are discussed for using breath regulation as an antecedent emotion regulation strategy. Future work is needed to determine whether breath regulation differentially impacts individuals with emotion disorders.

Funding: North American Society for Psychology of Sport and Physical Activity Graduate Student Research Grant.

PHYSIOLOGICAL INDICATORS OF EMOTION DYSREGULATION IN SELF-REPORTED SLEEP BRUXISM

Sylvia Kreibig, Jinxiao Zhang, Maia ten Brink, and James Gross
Stanford University

Descriptors: Sleep Bruxism, Emotion Regulation, Peripheral Physiology

Sleep bruxism is a sleep-related movement disorder that is characterized by high-frequency and high-intensity tooth grinding and jaw clenching during sleep. The etiology of sleep bruxism remains unclear but likely is multifactorial. Involvement of affective components, such as increased prevalence of anxiety and depressive disorders, heightened physiological stress indicators, and impaired coping skills, have been observed in sleep bruxism. As a transdiagnostic factor underlying psychopathology, we hypothesized that emotion regulation would be impaired in sleep bruxism. We tested this prediction in 104 participants with and without self-reported sleep bruxism by assessing psychophysiological measures of negative emotional reactivity and emotion regulation during a standardized laboratory computer task. Psychophysiological measures included self-reported feeling, cardiovascular, electrodermal, respiratory, and electromyographic measures. Results showed greater negative emotional reactivity during emotion regulation in individuals with versus without self-reported sleep bruxism, including greater negative feelings and greater corrugator supercilii reactivity. These results indicate impaired emotion regulation in individuals with sleep bruxism and suggest emotion regulation as a viable target for the development of new treatments for sleep bruxism.

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FEELING DISTRESSED UNDER THREAT REFLECTS AUTONOMIC COACTIVATION
Lily Seah, Brittany Nackley, and Bruce Friedman
Virginia Polytechnic Institute and State University

Descriptors: Subjective Experience of Distress, Autonomic Coactivation, Threat

Both sympathetic (SNS) and parasympathetic nervous systems (PNS) play critical roles in the defense mechanism against threat. Typical stress literature portrays reciprocal activation with SNS dominating the “fight or flight” response, while PNS may take over under extreme threat. The two systems can also be uncoupled or coactive. Though SNS and PNS activation under threat is well studied, their relationship with subjective experience of distress is less explored. To study this issue, ECG and impedance cardiography were obtained from 18 subjects (5 male; mean age 19.4) while they were exposed to a 13-min virtual-reality experience that simulated a threatening situation. Each subject provided 14 ratings on the subjective units of distress scale (SUDS) at one-minute intervals from baseline through recovery. Time series of cardiac pre-ejection period (PEP) was derived as a SNS index, and respiratory sinus arrhythmia (RSA) as PNS index. We calculated 30-second PEP and RSA averages prior to each SUDS rating, and then fitted a cumulative link mixed model to the data. Statistically significant results showed autonomic effects on SUDS: PEP (beta = -1.17, p < .001) and RSA (beta = -.46, p = .014) both had independent main effects, as well as interaction effect (beta = 0.66, p < .001). These results provide preliminary evidence that SNS and PNS activation affects the intensity of distress feelings. Specifically, the interaction effect of PEP and RSA on SUDS imply that the SNS and PNS may coactivate under threat.

AGE-RELATED EFFECTS ON FACIAL EMOTION RECOGNITION IN SCHOLAR CHILDREN
Sara Emmalee Espinosa Denenea, and Julieta Ramos-Loyo
University of Guadalajara, Mexico

Descriptors: Emotional Recognition, ERP, Children

Recent research has shown a gradual amplitude and latency decrease in early components (P1 and N170) during processing of emotional faces as age increases in scholar children. However, little is known about later stages related to the categorization processes during facial emotional recognition in children. The aim of this study was to identify age effects on behavioral performance and P1 and P3b components during the recognition of happy, angry, and sad faces. EEG was recorded on 57 participants divided in 3 age groups, 6, 8 and 10 years old. Children performed 5 oddball tasks, 2 of them were control conditions for identity and sex recognition and, the other 3 for happiness, anger and sadness recognition. We found an increase in accuracy and a decrease in omissions and reaction times as age increased regardless of the conditions. P1 and P3b latencies shortened with age, however no differences in amplitude were found. In addition, P1 amplitude was higher for identity than happiness and anger conditions and P3b amplitude was higher in sadness than in sex condition and it’s latency shorter in identity in comparison to the other conditions. Present results suggest a continuous improvement of face processing with increasing age, with faster processing at early perceptual and categorization stages. Also, children assigned more resources during categorization of sad faces.

EXPLORING ABNORMAL ERROR PROCESSING AMONG CARRIERS OF THE FMR1 PREMUTATION
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Descriptors: FMR1, ERN, Psychopathology

The Error Related Negativity (ERN) indexes neural sensitivity to errors and has been repeatedly found to be impacted in both internalizing and externalizing psychopathology. Similarly, carriers of the FMR1 premutation, the chromosomal abnormality which can lead to Fragile X syndrome in carriers’ offspring, are at increased risk for numerous psychiatric disorders, including depression, anxiety disorders, ADHD, and substance use disorders. In the current study, we assessed ERN on an arrow Flankers task in 14 carriers of the FMR1 premutation, and in 19 healthy controls. We found that while carriers and controls both generated an ERN in response to errors, the ERN was located less frontally in carriers than in controls. A repeated measures ANOVA of within subjects effects showed that there was a significant electrode × accuracy × carrier status interaction (F1, 31) = 6.69, MSE = 11.44, p = .015), such that in carriers of the FMR1 premutation, there was significant blunting of the ERN at electrode Fz relative to electrode Cz on error but not correct trials, and that this interaction was not present in the participants without the premutation. We plan to further explore these findings in the context of these participants’ cognitive functioning as indexed by the NIH toolbox and the Wechsler Abbreviated Scale of Intelligence (WASI-II). Overall, these findings represent an initial effort to phenotype a population at increased risk for a broad range of psychopathology, and suggest that abnormal error processing may play a role in this increased risk.

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ETHNIC DIFFERENCES IN COMMON INFLAMMATORY MARKERS: A SYSTEMATIC REVIEW AND META-ANALYSIS

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Descriptors: Inflammation, Ethnicity, Physical Health

Health disparities continue to be a critical area of focus for psychologists and physicians alike, as Blacks have consistently been shown to be afflicted with higher rates of health risk factors (e.g., hypertension) and chronic illnesses (e.g., cerebrovascular diseases) compared to Whites. The inflammatory response, or the body’s primary defense against infection, is implicated in a myriad of diseases and disorders, and may therefore be a contributing factor to these observed health disparities. However, there remains a lack of research that comprehensively examines ethnic differences in inflammation and how these differences are reflected in overall health. Therefore, the current meta-analysis aims to synthesize the extant literature to determine the magnitude of ethnic differences in several common inflammatory markers. A systematic literature search yielded 809 articles that were screened for eligibility, resulting in a final sample of 116 studies. Results revealed significant standardized mean differences for baseline CRP (Hedges’g = 0.302, SE = 0.074, CI = 0.156, 0.449, p < 0.001), Fibrinogen, IL-6, and Leukocyte Telomere Length, such that Blacks showed higher levels. Results also revealed significant differences for baseline TNF-α (Hedges’g = −0.219, SE = 0.068, CI = −0.386, −0.052, p = 0.01), IL-10, and sICAM-1, such that Whites showed higher levels. These findings provide evidence of marked ethnic differences in inflammation and suggest a proclivity for greater pro-inflammatory responses in Blacks compared to Whites with major implications for health disparities.

LONG-TERM RELIABILITY OF MEG ESTIMATES OF SPONTANEOUS CORTICAL ACTIVITY

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Descriptors: Test-Retest Reliability, Resting State, Oscillations

Spontaneous cortical activity during the resting-state has been extensively studied across a wide array of disorders. Establishing which spectrally- and spatially-specific components exhibit strong test-retest reliability is essential to move the field forward. While studies have shown short term reliability of MEG resting state activity, no studies have examined test-retest reliability across an extended period of time to establish the stability of these signals. Herein, we examined 18 healthy adults age 23-61 who completed three visits across three years. For each visit, participants completed both a resting state MEG and structural MRI scan. MEG data were source imaged and the cortical power in canonical frequency bands (delta, theta, alpha, beta, low gamma, high gamma) was computed. Intra-class correlation coefficients (ICC) were then computed across the cortex for each canonical band. Over the 194 years, power in the alpha and beta bands displayed the highest estimates of reliability, while gamma showed the lowest estimates of reliability. Spatially, delta, alpha and beta all showed the highest degrees of reliability in the parietal cortex. Interestingly, the peak signal for each of these frequency bands was located outside of the parietal cortex, suggesting reliability was not solely dependent on signal to noise ratio. In conclusion, resting state parietal delta, posterior beta, and alpha activity across most of the cortex are stable and reliable across three years.

Funding: This research was supported by grants R01-MH103220, R01-MH116782, R01-DA047828, R01-MH118013, and F30-DA048713 from the National Institutes of Health, and grant #1539067 from the National Science Foundation.

CONSIDERING AGE AS MODERATOR OF THE ASSOCIATION BETWEEN ANXIETY AND ERROR MONITORING EVENT-RELATED POTENTIALS IN YOUTH

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Descriptors: Anxiety, Error-related Negativity, Error Positivity

In youth, age has been proposed as a moderator of the association between anxiety and the error-related negativity (ERN), a neural response that occurs 0–100 ms after an error is made and indexes cognitive control. Anxiety is thought to relate to a larger ERN amplitude in children older than age 9 and to be unrelated or related to a smaller ERN in children younger than age 9. One study in youth also found that age moderated the association between anxiety and the error positivity (Pe), a neural response that occurs 150–750 ms after an error is made and reflects error awareness. However, the role of age in these associations remains unclear. Therefore, we examined age as a moderator of the association between anxiety symptoms and the ERN and Pe amplitudes in 194 youth (Age 4–13 years, M = 9.128 years, SD = 2.416). Findings revealed that anxiety was not related to the ERN amplitude or early Pe (150–350 ms). Greater GAD symptoms were associated with a larger late Pe (350–750 ms) irrespective of age. Categorical age moderated the association between GAD symptoms and the ERN, such that greater anxiety related to a significantly smaller ERN in 9-year-old youth, and no association was found in youth younger or older than age 9. Continuous and categorical age moderated the association between social anxiety symptoms and the late Pe difference wave, such that greater social anxiety symptoms related to a larger late Pe, but only in younger children. Our results suggest that the association between anxiety and error monitoring is developmentally-dependent and symptom-specific.

Funding: Lilianne M. Gloe is funded by the National Science Foundation Graduate Research Fellowship Program (GRFP) Data collection was funded by the National Institute on Drug Abuse (5R01DA039112-05, “Neurobehavioral Liabilities of Precursory Risk for SUDS in Children”, PI: C. Emily Durbin).
**Poster 3-036**

**EVALUATING DEVELOPMENTAL TRENDS AND SEX DIFFERENCES IN P3 AMPLITUDE AND LATENCY WITH A NOVELTY ODDBALL PARADIGM**

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**Descriptors:** Development, Sex Differences, Novelty Oddball  
Using the classic two-tone oddball paradigm to evaluate the P3, researchers have observed developmental improvements in the cognitive processing of simple tones. However, the developmental trajectory of P3 elicited by a novelty oddball paradigm (i.e., three tone conditions) is less understood. Further, the role of sex differences in P3 trends is unclear. In this study, we used a novelty oddball task to acquire ERP data from 204 typically developing participants aged 7–25. We evaluated the influence of participant traits, age and sex, on P3 amplitude and latency with multiple regression analyses as well as the interaction between tone types and scalp sites (Fz and Pz) with ANCOVAs. We found that P3 latency and P3 peak-to-peak amplitude decreased significantly from childhood to adolescence with varying trends in young adulthood depending on site or tone. Sex differences significantly predicted P3 amplitude for frequent tones at Fz, with females having larger P3 amplitudes than males. The most pronounced sex differences were in children, especially for target tones at Fz and novel tones at Pz. Results from ANCOVAs controlling for age, age-squared, and sex found a significant interaction between site, tone, and sex on P3 amplitude. Post-hoc tests showed that P3 amplitude for target tones was larger than frequent tones, smaller than novel tones, and larger at Pz than Fz. In sum, this study employing the novelty oddball paradigm reveals nuanced variations in developmental trends where cognitive processing changes from childhood to adulthood with females developing ahead of males.

**Funding:** National Institutes of Health/National Center for Medical Rehabilitation Research (NIH/NCMRR) grant K01HD001201.

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**Poster 3-038**

**INHIBITORY EVENT-RELATED POTENTIALS VARY BETWEEN CHILDREN AND ADULTS IN TWO GO/NOGO PARADIGMS HAVING DIFFERRING VISUAL COMPLEXITIES**

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**Descriptors:** Event-related Potential, Development, Perception  
The ability to inhibit an automatic response is a vital executive function for normal development. Go/NoGo paradigms are used to explore the neural correlates of inhibition by requiring participants to press a button for all stimuli except a specific stimulus requiring no button press. This study investigates whether visual quality of stimuli interacts with age to impact neural correlates of inhibition. Electroencephalographic data were collected from 29 neurotypical children between the ages of 4-8, and 31 adults aged 18–25, during two Go/NoGo paradigms: one with pictures of food on blank white backgrounds, and the other with pictures of zoo animals with complex, natural scene backgrounds as stimuli. Adults had significantly faster reaction times and better accuracy in both paradigms. After creating averaged evoked potentials, two ANOVAs were performed, one for each paradigm, comparing children and adults. A significant main effect of age and paradigm was found for the Novelty Oddball paradigm, with children showing better performance than adults. The Go/NoGo paradigm showed a significant main effect of age and sex, with adults showing better performance than children. Further analysis revealed a significant interaction between age and sex, with adults showing better performance than children, particularly for the Novelty Oddball paradigm. These findings suggest that visual quality of stimuli interacts with age to impact neural correlates of inhibition.

**Funding:** Department of Occupational Therapy and College of Health and Human Sciences, Colorado State University.

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**Poster 3-037**

**THE DEVELOPMENTAL TRAJECTORY OF SPONTANEOUS CORTICAL ACTIVITY**

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**Descriptors:** Magnetoencephalography, Resting-state, Development  
While many studies have examined the developmental trajectory of task-based neural oscillations during childhood and adolescence, the evolution of spontaneous cortical activity during this period is less understood. Herein, we examined spontaneous cortical activity in 111 typically-developing youth (ages 9-15 years; 55 male). Participants completed an eyes-closed resting-state MEG recording and a T1-weighted structural MRI scan. MEG data were source imaged to the cortex and power was computed for six canonical frequency bands (delta, theta, alpha, beta, low gamma, high gamma). To test for spatially-specific effects of age, sex, and their interaction, power spectral density maps were analyzed via vertex-wise ANCOVAs. Robust increases in power across the frontal cortices were observed with larger age in all frequency bands, which decreased over time. Sex effects were distributed across frontal and temporal regions: power was greater in delta and beta for males, and greater in alpha for females. There was an age-by-sex interaction in theta, such that power decreased in males and increased in females with age in the bilateral superior temporal cortices. These data suggest unique, robust patterns of change in spontaneous power as a function of age and sex during childhood and adolescence, with effects distributed across neural substrates that are critically implicated in high order cognition. Our findings contribute to the field’s fundamental understanding of spontaneous cortical activity during this dynamic period of development.

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**Poster 3-039**

**COORDINATED PATTERNS OF CARDIAC AUTONOMIC REACTIVITY ASSOCIATED WITH BETTER SOCIAL FUNCTIONING**

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**Descriptors:** Social Skills, Autonomic Nervous System, Children  
Sympathetic (SNS) and parasympathetic (PNS) activity have been linked to childhood social functioning. However, the majority of past studies have focused on the SNS or the PNS in isolation. The current study utilized simultaneous recordings of PNS and SNS activity to investigate how both branches of the autonomic nervous system might interact in predicting social skills. Methods. Children (N = 150) ages 9-11 years reported on self-control, cooperation, empathy, and assertiveness using the Social Skills Rating System (SSRS). SNS and PNS activity were derived from pre-ejection period (PEP) and respiratory sinus arrhythmia (RSA), respectively, at baseline and during a social stressor or a no stress control. Linear regressions tested the interaction between ΔPEP and ΔRSA, in relation to each SSRS subscale, controlling for age, sex, SES, baseline PEP, baseline RSA, and stress condition. Results. Results revealed negative relations between ΔPEP and each SSRS subscale. In addition, ΔRSA moderated the associations between ΔPEP and both self-control and assertiveness. Simple slopes analysis showed that the relations between high ΔPEP and poorer self-control and assertiveness were significant when the child exhibited moderate or low ΔRSA (p’s < .05), but not when the child effects distributed across all frequencies (p’s > .27). Discussion. Elevated SNS reactivity was associated with poorer social skills, but only for children who failed to also exhibit high PNS reactivity. Coordinated activation of the SNS and PNS may be an adaptive physiological profile that helps children engage in social situations.
A NEED FOR SPEED: FACIAL PROCESSING LATENCY IS ASSOCIATED WITH SOCIAL ACCEPTANCE IN CHILDHOOD

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Descriptors: ERP, Facial Processing, Emotion
The ability to rapidly and accurately process emotional facial cues is an important marker of effective social cognition and communication. Event-related potentials (ERPs) provide important information about individual differences in neurocognitive processes that underlie these abilities, though evidence in children remains sparse. The present study utilized data from n = 219 first graders (Mage = 7.18; 65% male; 70% Black) oversampled for externalizing behaviors. We leveraged multilevel modeling to examine the association between social acceptance, indexed by peer reports, and early attentional processing (P1, N170) of neutral, angry, and fearful faces. No association was found between social acceptance and ERP amplitudes. However, higher social acceptance was associated with shorter N170 latencies to angry (gamma = −6.1, p = .02) faces relative to neutral faces, whereas children lower in social acceptance did not differentiate among face type in N170 latency. Furthermore, those lower in social acceptance demonstrated longer P1 latencies (gamma = 3.4, p = .02) across all faces. These patterns suggest that children who struggle socially may be characterized by slower attentional engagement with faces at early perceptual stages. This neural inefficiency may lead to less fluid social interactions and deficits in the rapid detection of early emotional cues, ultimately resulting in difficulties effectively engaging with peers.

COMPARING MODEL FIT AND OPTIMAL PARAMETERS OF PHYSIOLOGICAL LINKAGE MODELS DURING DYADIC EMOTION COMMUNICATION

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Descriptors: Physiological, Linkage, Emotion
Physiological linkage analyses use a variety of statistical methods to explore complex dynamic patterns of physiological coordination between interaction partners. To compare two such statistical methods, we fitted coupled oscillator and inertia-coordination models to minute-long periods of dyadic cardiac data and recorded the parameters leading to best model fit for each model type. Data were adapted from equispaced cardiac interbeat intervals (IBIs) in female stranger dyads (n = 51) while partners took turns communicating various emotions. Dynamic equations modeling IBI linkage were reduced using latent profile analysis to an appropriate number of profiles representing interaction patterns for each observation period. The coupled oscillator model fit best when time points were smoothed using a 6-second moving average and second derivatives, and yielded a 2-profile solution. The inertia-coordination model fit best when the number of lagged seconds between interaction partners was defined dynamically based on maximum cross-correlation between partners, and yielded a 3-profile solution. The coupled oscillator model fit the data better than the inertia-coordination model did (ΔR² = .50, p < .01). Lastly, the inertia-coordination model profiles suggested patterns of in-phase, antiphase, and phase-independent interactions. The results suggest that physiological linkage results can vary by type and parameterization of model used.

PHYSIOLOGICAL LINKAGE DURING EMOTION COMMUNICATION VARIES BY EMOTION TYPE

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Descriptors: Linkage, Cardiac, Emotion
People can successfully communicate emotions to one another through touch alone, and physiological linkage between interaction partners may help explain this ability. Prior work has illustrated significant linkage of cardiac activity between stranger dyads during communication of emotion via touch compared to baseline periods, but fewer studies have explored how linkage profiles may differ by type of emotion communicated (e.g., anger, happiness). In order to explore this question further, cardiac interbeat intervals were recorded in female stranger dyads while partners took turns communicating and receiving a randomized list of 10 emotions (neutral, anger, fear, love, gratitude, sadness, happiness, sympathy, surprise, and disgust). Interbeat intervals were converted to equispaced time series values, which were analyzed for dynamic linkage equations between partners and within emotion conditions. Linkage equations were then reduced using latent profile analysis to 2 profiles representing patterns of interaction during emotion communication periods. Subsequent logistic regression analysis revealed distinctive linkage profiles for the baseline period (X² = 7.11, p<.01), anger communication (X² = 4.56, p<.05), and happiness communication (X² = 4.47, p<.05). The results suggest that different emotions shared between people are at least somewhat distinguishable by the patterns of physiological linkage that they engender.

GO/NO-GO P300 AMPLITUDE OF YOUTH WITH DEPRESSION BEFORE AND AFTER MINDFUL BREATHING TRAINING PAIRED WITH TRANSCRANIAL DIRECT CURRENT STIMULATION

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Descriptors: Depression, Transcranial Direct Current Stimulation, P300
The current study is investigating the efficacy of mindful breathing training (MBT) paired with transcranial direct current stimulation (tDCS) or sham for youth aged 17 to 24 with depression. In this double-blinded, sham-controlled investigation, participants are randomized to receive MBT with either 2 mA anodal tDCS or sham, targeting the left dorsolateral prefrontal cortex. Participants complete a visual Go/No-Go task in the context of electroencephalography (EEG) before and after eight to ten intervention sessions. P300 amplitudes were examined for 25 participants before and after intervention. A 2 x 2 repeated measures analysis of variance was conducted with two levels of trial type (Go and No-Go) and two levels of time (baseline and post-intervention). As expected, there was a significant main effect of trial type (F(1, 24) = 17.47, p < .001), indicating the mean amplitude of No-Go trials (M = 5.05, SD = 3.39) was significantly greater than Go trials (M = 3.23, SD = 2.67). The main effect of time and the interaction between time and trial type were non-significant (p's > .05). Preliminary results did not reveal a significant change in P300 amplitude from baseline to endpoint when considering both treatment groups together. Results demonstrate the feasibility of implementing a randomized control trial involving neuromodulation and MBT in youth with depression, and of collecting EEG data to consider biomarkers of treatment response. Future work, following the completion of data collection, will examine group differences in Go/No-Go P300 amplitude change after intervention.

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**Poster 3-044**

**BEYOND CORRECT VS. INCORRECT: INVESTIGATING GRADED FEEDBACK PROCESSING IN A MORE NATURALISTIC SKILL LEARNING PARADIGM**

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**Descriptors:** RewP, Reward, Motor Skill

According to reinforcement learning theory, humans make decisions and behavior adaptations based on reward-prediction errors, the difference between actual and anticipated outcomes. In human research, reward-prediction errors have been studied through the proxy measure of the ERP component reward positivity (RewP). Studies investigating the relationship between RewP and behavior mostly relied on paradigms in which outcome feedback is dichotomous (e.g., correct vs. incorrect). However, in naturalist skill learning settings, outcome feedback is presented in a more graded manner (e.g., "you missed the target by about 40 cm"). Thus, it is important to examine the RewP in such naturalistic settings for a more ecologically-valid assessment of learning processes. Accordingly, in the present study we recorded EEG from 64 participants while they practiced a nondominant arm beanbag tossing task and received graded feedback. We quantified the RewP elicited by the graded feedback on a trial-by-trial basis and used a linear mixed-effects model to regress it on the accuracy of each trial while also testing whether this relationship changed over time. Therefore, results of this study support the use of the RewP as a measure of reward-prediction errors in more naturalist skill learning paradigms and shed light on the dynamic changes in reward-prediction errors during practice.

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**Poster 3-045**

**TASK EFFECTS ON HEART RATE VARIABILITY (HRV) DURING VISUOSPATIAL ATTENTIONAL SET-SHIFTING: VAGAL DYSREGULATION IS ASSOCIATED WITH FAILURE TO SET-SHIFT**

Breannan Howell and Derek Hamilton

University of New Mexico

**Descriptors:** Behavioral Flexibility, Heart Rate Variability, Task Effects

Heart rate variability (HRV) has been associated with differences in executive function and regulation capabilities in both normal and clinical populations (Forte et al, 2016). HRV also appears to be negatively affected by the environmental factors, with effects being reported in response to both physical and mental demands (Melo, et al, 2017, Segerstrom & Nes, 2007). To investigate task effects on HRV during place learning and set-shifting, the Virtual Morris Water Task (VMWT) and a classic attention set-shifting paradigm were combined to create the set-shifting variant of the VMWT. ECG measures were recorded before (baseline), during (task), and after (recover) the task. Root mean square of successive difference (RMSSD), log high frequency HRV (HF-HRV), log low frequency HRV (LF-HRV), and heart rate (HR) were calculated for 5-min intervals at baseline, task, and recovery. In participants that completed the task (Complete: \(N = 34\)), RMSSD and HF-HRV were significantly reduced during the VMWT and remained decreased during recovery when compared to HRV at baseline. This relationship was not found in individuals who failed to complete the task (Failed Shift: \(N = 12\), Failed Learn: \(N = 6\)). These findings suggest that the VMWT significantly negatively affects HRV during successful place learning and task-switching. Further, HRV remains lowered post-task during a 5-min recovery period. Individuals who failed to perform the set shift did not exhibit this effect, suggesting cardiac vagal dysregulation may be associated with decreased behavioral flexibility.

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**Poster 3-046**

**COUNTERMEASURE PRACTICE EFFECTS ON A P300-BASED PROTOCOL FOR INFORMATION DETECTION: EPISODIC VS SEMANTIC MEMORY**

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Northwestern University

**Descriptors:** P300, CIT, Memory

This study applied a countermeasure-resistant version of the Concealed Information Test—the Complex Trial Protocol—in an information recognition scenario. We investigated the effect of either practicing or not practicing a novel countermeasure on the recognition of either episodic or semantic information. We measured participants' response time and P300 brainwave response to rare, crime-relevant probe stimuli, or frequent, non-crime-relevant irrelevant stimuli. We hypothesized that countermeasure use would only impair information recognition (as indexed by P300) when participants had practiced the countermeasure beforehand. We further hypothesized that recognition of episodic information would be more impaired by countermeasure use than recognition of semantic information. Preliminary results (Semantic group: practice \(n = 22\), non-practice \(n = 23\); Episodic group: practice \(n = 19\), non-practice \(n = 18\)) from a mixed ANOVA suggested a three-way interaction \((p = .012)\) between countermeasure use (practice vs non-practice), memory type (semantic vs episodic), and stimulus type (probes vs irrelevants). These preliminary data seem to support our hypotheses, suggesting that the countermeasure had no effect on the recognition of semantic probes regardless of practice, whereas the countermeasure impaired the recognition of episodic probes, but only when participants were able to practice the countermeasure beforehand.

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**Poster 3-047**

**LEARNING UNDER STRESS ELECTROPHYSIOLOGICAL EVIDENCE THAT ACUTE STRESS IMPAIRS STRATEGIC ENCODING PROCESSES**

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**Descriptors:** Anxiety, Encoding

Acute anxiety can negatively impact memory, but the underlying mechanisms are not well understood. One theory is that anxiety enhances early sensory-perceptual processes at the expense of late, goal-directed processes, including the use of meaning-based or elaborative encoding strategies. To test this idea, in two experiments, we asked participants to view and attempt to recall two sets of words, one of which was encoded in a stressful context using the threat-of-shock paradigm (threat blocks), and one of which was encoded without threat (safe blocks). In Experiment 1, we found that significantly fewer words were recalled during threat than safe blocks. Experiment 2 was identical to Experiment 1, except ERP were recorded during study to directly examine the effects of threat on early and late processing stages. Relative to safe blocks, words studied during threat blocks elicited larger (more negative) N400 amplitudes, indicative of more difficult semantic access. In addition, the amplitude of a late frontal positivity linked to elaborative encoding was reduced during threat blocks. No differences between conditions were present in early sensory potentials. In contrast to Experiment 1, overall rates of word recall did not differ between conditions; however, the aforementioned ERP effects were most pronounced in those participants who showed worse recall during threat blocks. Overall, these results support the notion that threat disrupts memory encoding by interfering with the ability to implement effective encoding strategies.
Poster 3-048

AGE-RELATED DIFFERENCES IN EEG OSCILLATORY SUBSEQUENT MEMORY EFFECTS

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Descriptors: Cognitive Aging, Theta, Alpha/Beta Desynchronization
The present study investigated age differences in the oscillatory correlates of successful memory encoding. Healthy young (N = 44) and older (N = 44) adults viewed images of scenes and objects while undergoing EEG recording for a subsequent memory test. Behaviorally, recognition accuracy was lower in older adults compared to younger adults. A time-frequency analysis identified age-variant and age-invariant subsequent memory effects in the theta, alpha, and beta frequency bands (regardless of image type). The age-invariant subsequent memory effects included a late onsetting frontal theta desynchronization (4–7 Hz; ~740–1,450 ms) for subsequent hits relative to misses, low beta desynchronization (13–17 Hz; ~660–1,400 ms) over right parietal-occipital channels, and low- and high-beta synchronization (13–28 Hz; ~1310–1,500 ms) over left central and parietal channels. Age-variant subsequent memory effects were observed in theta over occipital channels and in alpha (8–12 Hz) over occipital (100–1,500 ms) and frontal (630–1,000 ms) channels. All the age-invariant effects took the form of theta and alpha desynchronization for subsequent hits relative to misses in older adults, but not in younger adults. These findings corroborate some previous studies of neural oscillations and memory performance and help identify the neural correlates of age-related memory decline. Future research is needed to identify the role of theta desynchronization to memory encoding in older adults.

Funding: This research was funded by a National Institute on Aging grant (R56AG068149) awarded to J.D. Koen.

Poster 3-049

INTERNAL CONSISTENCY AND STABILITY OF THE LATE POSITIVE POTENTIAL DURING AN EMOTION REGULATION TASK IN OLDER ADULTS

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Descriptors: Late Positive Potential, Older Adults, Emotion Regulation
The late positive potential (LPP) is thought to index emotional engagement and may be clinically useful for studying emotion regulation (ER) deficits across populations. Despite research using the LPP as a neural indicator of ER, little research to date has assessed the psychometric properties of the LPP during an ER task in older adults. The current study examined the reliability of the LPP during an ER task in 42 older adults (M = 68 years); 18 of which completed the same task about 3 months later. Participants viewed negative or neutral stimuli for 7 s and were instructed to attend (i.e., react trials) or reframe their emotional response (i.e., reappraise trials). Internal consistency and test-retest reliability were assessed for pre- (500–1,000 ms) and post-instruction LPPs (>1500ms). At baseline and follow-up, internal consistencies were acceptable-to-good for pre-instruction LPPs (rs = .60–.89) and poor-to-acceptable for post-instruction LPPs (rs = .14 to .76). Test-retest reliability of the pre-instruction LPPs were good (rs = .71–.78) and the post-instruction LPPs were poor-to-good (rs = .16–.69). Internal consistency and test-retest reliability were highest for reappraise compared to react trials. These findings indicate that the LPP exhibits poor-to-good reliability in older adults. Future work could examine data quality and subject-level reliability metrics to gain insight into factors that influence the psychometric properties of the LPP and advance its clinical utility.

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Poster 3-050

ERROR AND REWARD PROCESSING IN SUBSTANCE USE DISORDERS: EVIDENCE FROM A META-ANALYSIS ON EVENT-RELATED POTENTIALS

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Descriptors: Addiction, Meta-analysis, Feedback-related negativity
Individuals with substance use disorders (SUDs) often display dysfunctional error and feedback processing, contributing to impaired decision-making. The error-related negativity (ERN) and the feedback-related negativity/reward positivity (FRN/RewP) are two event-related potential (ERP) components that occur in response to behavioral errors and performance feedback, respectively. The literature reports amplitude differences in SUDs compared to controls; however, the direction and size of the overall effect is unclear. The current study used meta-analysis to estimate the effect size of the relationship between each ERP component and SUDs via the standardized mean difference (SMD) comparing users to controls. FRN/RewP results (k = 12) indicated a non-significant SMD, Hedge's g = -0.46 (z = -1.28; p = .199). Sub-group analyses (alcohol and active use disorder only) also indicated non-significant results. However, meta-regression revealed moderation by population type (p = .038), such that FRN/RewP in users was more enhanced in community compared to undergraduate samples by an SMD of g = 1.33. ERN results (k = 15) indicated a significant SMD of g = -0.46 (z = 0.36; p = .032), with controls displaying a larger ERN than users. There was non-significant evidence for moderation by population type (p = .009); only the SMD for substance users in emotional community was significantly different from zero (p = 0.45, p = .033). The need for additional research on the ERN and FRN/RewP in substance use populations and for consistency in reporting and defining these components is discussed.

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Poster 3-051

EFFECTS OF EMOTIONAL AROUSAL AND CLINICAL ANXIETY ON ELECTROCORTICAL CORRELATES OF APPROACH/AVOIDANCE PROCESSING: AN EVENT-RELATED POTENTIAL STUDY

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Descriptors: Emotional Arousal, Approach-Avoidance Task, Event Related Potential
Electrocortical correlates of approach/avoidance processing have been examined in healthy and psychiatric samples with an Approach-Avoidance Task (AAT) in which participants use a joystick. While AAT event-related potential (ERP) work has putatively tested effects of emotion on N200 (conflict resolution) and LPP (picture processing) components (e.g., Ernst et al., 2013), it, to date, typically has used only disorder-relevant (as opposed to generally emotional) images in psychiatric samples and/or has not included neutral stimuli. Here, then, we tested how emotional arousal impacts AAT ERPs in healthy and clinically anxious individuals using generally unpleasant, pleasant, and neutral pictures. 17 anxious treatment-seekers and 18 controls completed an AAT in which each trial presented an unpleasant, pleasant, or neutral scene with a blue or green border that signaled whether participants should rapidly push or pull a joystick to decrease or increase image size. Using 32 active sensors, a frontal N200 component was found to have decreased amplitude during emotional compared to neutral pull trials and increased amplitude during emotional compared to neutral pull trials. Valence X Response (F2, 32) = 15.9, p < .001. For a parietal LPP, amplitude was enhanced for unpleasant compared to neutral images regardless of response condition, Valence F2, 32) = 7.7, p = .004. For both components, clinical status did not moderate any effect. Together, these effects suggest general emotional arousal effects on approach/avoidance response processing (N200) that are not impacted by clinical anxiety.

Funding: MUSC Department of Psychiatry and Behavioral Sciences Chairman’s Research Development Fund.
NEW INSIGHTS INTO NEURAL NETWORKS OF ERROR MONITORING AND CLINICAL IMPLICATIONS: A SYSTEMATIC REVIEW OF ERP STUDIES IN NEUROLOGICAL DISEASES

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Descriptors: Error-related Negativity, Error Positivity, Neurology
Error monitoring allows for efficient performance of goal-directed behaviors and successful learning. Furthermore, error monitoring, as a metacognitive ability, is thought to contribute to the emergence of self-awareness and may play a crucial role in neuropsychological interventions, such as rehabilitation. In the past decades, research has suggested two electrophysiological markers for error monitoring—the error-related negativity (ERN) and the error positivity (Pe)—reflect, respectively, error detection and error awareness. Studies on several neurological diseases have investigated the alteration of ERN and Pe. A systematic review was conducted to understand what neurological conditions present alterations of error monitoring event-related potentials (ERP) and their relation with clinical measures. Overall, the ERN was found to be reduced in neurological conditions, while results related to the Pe are less clear. ERN amplitude was found to be associated with measures of clinical severity across different conditions. Additionally, we explored the contribution of different brain structures to neural networks underlying error monitoring, further elaborating on domain-specific mechanisms of error processing and clinical implications of findings.

WORKING MEMORY TRAINING PRODUCES ENHANCEMENT OF EVENT-RELATED POTENTIAL COMPONENT AMPLITUDE IN PEOPLE WITH MULTIPLE SCLEROSIS

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Descriptors: Working Memory, Event-Related Potentials, Multiple Sclerosis
Neurophysiological methods can provide useful measures for characterizing plasticity associated with cognitive rehabilitation in cognitively impaired individuals. Cognitive impairment is common in people with multiple sclerosis (PwMS) and impacts a variety of functional outcomes. But there has been relatively limited research regarding the neurophysiological underpinnings of cognitive rehabilitation in PwMS. In the present study, PwMS were semi-randomly assigned to one of three groups: (1) working memory (WM) training (visual-letter n-back task), (2) perceptual speed (PS) training (letter array visual search task), and (3) no-contact control (controlling for test-retest effects). The WM and PS training groups completed 20 training sessions (25–30 min each, difficulty adaptively adjusted throughout training). Before and after training (pretest/posttest), EEG data were obtained for a visual-letter 2-back task, and event-related potentials (ERPs) were derived. The WM training group exhibited significant improvement on 2-back performance (accuracy/reaction time), as well as pronounced enhancement of frontal-central N2 component amplitude (200–300 ms post-stim) and parietal P3 component amplitude (300–500 ms post-stim), from pretest-to-posttest on the 2-back task. These effects were not observed for the other study groups. The N2 and P3 findings indicate that WM training may produce improved stimulus conflict resolution and categorization, respectively, in PwMS. The WM training approach used here could therefore be a viable component of cognitive rehabilitation strategies in MS.

Funding: Research Grant from the National Multiple Sclerosis Society.
THE TEMPORAL VARIABILITY OF RESTING-STATE BRAIN: USEFULNESS OF MSSD AS NEURAL BIOMARKER

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Descriptors: MSSD, Dynamic Connectivity, Resting-state
The brain connectivity of resting-state fMRI (rs-fMRI) represents an intrinsic state of brain architecture, and it has been used as a useful neural marker for detecting developmental disabilities such as autism spectrum disorder, as well as psychiatric conditions such as acute stress. However, most studies using brain connectivity as a biomarker have focused more on the strength of functional connectivity over time (static-FC) than temporal features of connectivity changes (dynamic-FC). The primary goal of the current study is to investigate the effectiveness of using dynamic-FC in classifying an individual’s psychosocial and pathological characteristics from others. To this end, the rs-fMRIs of an autism dataset, ABIDE, were used. The static-FC and the dynamic-FC matrices were calculated for brain regions from the AAL2 atlas. Moreover, the temporal variability of functional connectivity was computed using the mean square successive difference (MSSD). When the static-FC and the MSSD were used in the support vector machine to classify individuals with autism and typical controls, the features including both static-FC and MSSD showed significantly higher accuracy than the features of static-FC solely. Similarly, we also found that additional inclusion of MSSD improves prediction of individual’s non-clinical characteristic such as age. These findings suggest that the temporal feature of functional connectivity is an important and useful neural biomarker to identify individual’s psychosocial and pathological characteristics.

Cardiac Autonomic Balance, Cardiac Regulatory Capacity

According to biopsychosocial theories of borderline personality disorder (BPD), non-supportive and supportive parenting predict BPD development, by interacting with biological vulnerabilities. Sym pathetic (PEP) and parasympathetic (RSA) responses, especially their relative strength (i.e., cardiac autonomic balance (CAB) and regulatory capacity (CAR)), may characterize youths’ sensitivity to parenting. We tested interactions between CAB and CAR with supportive and non-supportive parenting in predicting baseline levels and trajectories of BPD symptoms. N = 162 psychiatric youth (Mage=13.03; 47% female) engaged in a conflict discussion with their parents. RSA were measured continuously and used to calculate CAB and CAR. Parents and youth reported on supportive and non-supportive parenting. Youth reported on BPD symptoms at baseline and at 9- and 18-month follow-up. Latent BPD levels and trajectory of change were modeled. Increased sympathetic dominance amplified the effect of non-supportive parenting on adolescent BPD outcomes, predicting higher baseline BPD symptoms and slower decreases over time. Parasympathetic dominance amplified the protective association of supportive parenting with BPD outcomes, predicting fewer BPD symptoms at baseline. Sympathetic/parasympathetic coactivation independently predicted a slower decline in BPD symptoms. Results support contemporary developmental models of biological sensitivity to context, in which biological vulnerabilities, indexed here by CAB and CAR, interact with supportive and non-supportive parenting to shape BPD development.

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CORTICAL MEASURES TO DISSOCIATE HOARDING DISORDER FROM OBSESSIVE-COMPULSIVE DISORDER

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Descriptors: Hoarding Disorder, Obsessive-compulsive Disorder, Alpha Oscillation
Abnormal visual processing is often at the core of dysregulated, excessive fear responses as seen in disorders along the anxiety spectrum, such as obsessive-compulsive disorder (OCD) and hoarding disorder (HD). Although HD is an independent diagnosis, hoarding symptoms may co-occur with OCD, complicating differential diagnosis of the disorders. The present study examines indices of visual processing to determine the extent to which the neural mechanisms underlying visual processing are similarly compromised in HD and OCD. We used time-frequency analysis to examine alpha-oscillatory power activity and to quantify inter-trial phase locking within the occipital cortex. Thirty-three individuals with HD, 26 with OCD and 35 healthy controls (HC) were assessed during a visual flanker test. The results showed greater parieto-occipital alpha reduction in the HD group in comparison to the OCD and the control group, suggesting that to process the same visual stimuli HD individuals show more excitation over the sensory cortex than the other groups. Furthermore, the HD group showed less inter-trial phase consistency in comparison to the OCD and the HC groups. In other words, the neural network contributing to visual processing was less synchronous within the HD groups, which may reflect deficits in the temporal organization of visual processing. Taken together, our results are consistent with the view that hoarding disorder individuals show inefficient visual processing. Additionally, we provided objective tools to help discriminate between hoarding disorder and OCD.

Funding: This work was partially supported by the Center for OCD, Anxiety and Related Disorders at the University of Florida.
INVESTIGATING CONCURRENT AND LONGITUDINAL ERP-SYMPYOM RELATIONSHIPS AMONG RISK FOR PSYCHOSIS

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Descriptors: Schizophrenia, ERP, Longitudinal
Cognitive impairments in schizophrenia include abnormalities in executive function, attention, and semantic processing. ERPs are used as neurophysiological measures of cognitive impairment that have been shown to map onto symptom dimensions of psychotic disorders, such as schizophrenia. While much research exists on schizophrenia, less is understood about longitudinal relationships between a battery of ERPs and symptom dimensions (e.g., P300/positive, ERN/negative, N400/disorganized relationships) across a single sample of individuals at risk for psychosis. Community participants exhibiting psychosis-risk were recruited (n = 57). Eligible participants completed a baseline and 6-month follow-up (n = 29) assessment. ERPs were recorded during baseline assessment. While not significant, small effects emerged at baseline for P300/positive (r = -0.11, p = .40) and ERN/negative (r = 0.21, p = .12) symptom pairs, and in expected direction. The relationship between N400/disorganized symptoms (r = 0.18, p = .45) was not significant and opposite of expected direction. Interestingly, at follow-up, N400/disorganized symptom relationship correlated strongly and in the expected direction (r = 0.48, p < .05), though this effect did not hold in a simultaneous regression model controlling for other ERP components. These data provide evidence that N400 may be utilized as a biomarker to prospectively predict worsening of symptoms in the relatively near future (i.e., 6 months).

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Poster 3-061

EXECUTIVE CONTROL NETWORK RESTING STATE FMRI FUNCTIONAL CONNECTIVITY DIFFERENCES IN OPIOID USE DISORDER

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Descriptors: Opioid Use Disorder, fMRI. Functional Connectivity
Resting state functional magnetic resonance imaging (fMRI) functional connectivity has been used as a tool to study brain mechanisms associated with addictions. Recent research in substance use disorders has focused on three brain networks termed the default mode network (DMN), salience network (SN), and executive control network (ECN). The purpose of this study was to examine those three networks in opioid use disorder (OUD) subjects compared to healthy control subjects (HC). The present study investigated functional connectivity differences between OUD subjects compared to HC. This study also examined the relationship between functional connectivity and negative urgency scores, as well as compared the functional connectivity of severe OUD to mild or moderate OUD. In OUD subjects (n = 25) compared to HC (n = 25), a cluster in the left dorsolateral prefrontal cortex within the left ECN had significantly weaker functional connectivity (Cohen’s d = 1.455). No significant differences were found between groups for the functional connectivity of the DMN, SN, or right ECN. No significant associations between functional connectivity and negative urgency or differences between severe OUD and mild or moderate OUD were found. These results suggest that ECN functional connectivity may differ between OUD and HC. This finding is consistent with previous research showing altered executive function in OUD and supports further examination of ECN functional connectivity in association with treatment response in OUD.

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Poster 3-062

DECODING COVERT ATTENTION ON AN ORIENTATION PERCEPTION TASK FROM EEG ALPHA ACTIVITY

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Descriptors: Attention, Alpha, Decode
Alpha oscillations (8–14 Hz) were the first electroencephalograph (EEG) frequency band identified and are thought to have a critical role in visual perception and attention. However, despite its long history, it is unclear whether alpha power alone or alpha’s modulation of faster frequency bands best accounts for attentional and perceptual task performance. To address this question, we extracted phase-amplitude coupling (PAC) and amplitude-amplitude coupling (AAC) metrics, as well as alpha power alone. Then, we trained a support vector machine (SVM) on the pattern of the three metrics to test whether covert attentional states and subsequent behavior can be decoded from alpha power alone or from alpha modulated gamma activity prior to target onset. The data to be analyzed was collected from 28 participants performing a cued orientation perception task while EEG was recorded simultaneously. The task consisted of an informative cue (indicating right or left side) or uninformative cue (indicating both the left and right), then a target on the left or right-pointing in one direction followed by a backward mask, a short delay, and then a response screen. Errors on each trial were quantified as the difference between the target orientation and the orientation of participants’ responses. Initial results indicate that the AAC and alpha amplitude alone contains to most decodable pattern for classification of attention and subsequent behavior, but there is a lot of variability in the temporal pattern within and between participants that need further analysis.

Poster 3-063

THROUGH THE CAMERA INTO THE BODY: A PHYSIOLOGICAL STUDY INVESTIGATING THE EFFECT OF CAMERA MOVEMENT ON LEG MOTOR ACTIVATION

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Descriptors: Embodiment, Perception/Action, Media
This exploratory study looks at the potential effect of camera movement on the somatic nervous system. We hypothesize that global optic flow yielded by a camera acts as a visual cue for self-motion, leading to motor activation on the viewer’s leg compared to a static perspective. The experiment (N = 57) used a 2 (Camera: Moving vs. Static) × 4 (Message repetition) mixed design. The stimuli, obtained from feature films and TV shows, were between 90 and 180 s. All participants saw all four Moving Camera clips (recorded by a Steadicam or a shoulder-held camera) and two of the four Static Camera clips (recorded on a tripod), randomly assigned. Psychophysiological measurements were recorded during film viewing including heart rate, skin conductance, and leg electromyography on the muscle tibialis anterior (EMG). 7-point Likert scales were used for participants to rate how positive, negative, and emotionally aroused they felt while watching the videos. A cross-classified multilevel model was used to analyze iEMG, with random intercepts for both Subject and Stimuli, and random slopes for Time and Condition. We found that, as hypothesized, the Moving Camera led to higher iEMG activation than the Static Camera even after controlling for physiological and self-reported arousal (beta = .198, p < .01). Additionally, there was a significant interaction between camera and self-reported arousal (beta = -.026, p < .001). Self-reported arousal and leg motor activation were positively correlated for the Static Camera but negatively correlated for the Moving Camera.
A THREE-SUBJECT PRACTICE STUDY ON DISORDERED BREATHING RELATED TO COMPRESSION CHEST BINDING, WHICH MAY CAUSE ANXIETY

Bonnie Cardell
Saybrook University

Desectors: Trans Masculine Identity Spectrum (TMIS), Anxiety, Hypocapnia

People on the Trans Masculine Identity Spectrum (TMIS) whom chest bind may experience anxiety due to decreased breathing efficiency due to the restriction on breathing from tight chest binders. The research supports a correlation between anxiety and restricted breathing through the chest binders. The study examines the effects of compression chest binding on hypcapnia, by measuring end-tidal carbon dioxide (EtCO₂). It intended to determine the viability of a more extensive pilot study. The idea for the study emerged from observations of clients in a psychiatric facility who experience anxiety frequently due to compression chest binders. The study employed two EEG frequency measures during native, fluent non-native, and non-fluent language Horror-fiction reading. Frontal Alpha Asymmetry (FAS) provides a reliable index for approach/withdrawal motivation, useful for quantifying emotional responses, and Frontal Midline Theta (FMT) indexes cognitive fatigue to control for task difficulty. This study hypothesizes FAS should be more negative for native English speakers (NE) compared to non-native (NN) speakers; secondly, FMT should not significantly differ between these groups. The English native-ness comparison suggests, contrary to the hypothesis, a withdrawal response from the NN group (F1, 22) = 6.06, p = .02, r² = 0.22, MNN = −0.02, MNN = 0.03). No significant difference in FMT was found (F1, 22) = 0.94, p = .34). Post-task valence, as self-reported via Self-Assessment Manikin, do not reflect this effect (F1, 22) = 0.04, p = .85 for the effect of English native-ness). These results may be interpreted as differences in language lateralization for native- and non-native reading, as early bilinguals (the NN group) demonstrate more bilateral language processing compared to late-bilinguals (the NE group who are late learners of French).

Funding: All funding for this study provided by Purdue University.

INTRICACIES OF ASYMMETRY: THE FOREIGN LANGUAGE EFFECT IN HORROR FICTION READING

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Purdue University

Desectors: Frontal Alpha Asymmetry, Bilingualism, Affect

The foreign language effect (FLE) purports to distinguish between native- and non-native speakers in processing spoken or written information and is typically observed when speakers process and respond to moral dilemmas. However, various factors, particularly cultural norms, influence this effect. To quantify the FLE while controlling for cultural differences, this study employs two EEG frequency measures during native, fluent non-native, and non-fluent language Horror-fiction reading. Frontal Alpha Asymmetry (FAS) provides a reliable index for approach/withdrawal motivation, useful for quantifying emotional responses, and Frontal Midline Theta (FMT) indexes cognitive fatigue to control for task difficulty. This study hypothesizes FAS should be more negative for native English speakers (NE) compared to non-native (NN) speakers; secondly, FMT should not be significantly different between these groups. The English native-ness comparison suggests, contrary to the hypothesis, a withdrawal response from the NN group (F1, 22) = 6.06, p = .02, r² = 0.22, MNN = −0.02, MNN = 0.03). No significant difference in FMT was found (F1, 22) = 0.94, p = .34). Post-task valence, as self-reported via Self-Assessment Manikin, do not reflect this effect (F1, 22) = 0.04, p = .85 for the effect of English native-ness). These results may be interpreted as differences in language lateralization for native- and non-native reading, as early bilinguals (the NN group) demonstrate more bilateral language processing compared to late-bilinguals (the NE group who are late learners of French).

Funding: All funding for this study provided by Purdue University.
**Poster Session 3-068: Late-breaking Student Poster**

**AGE DOES NOT MODERATE THE RELATIONSHIP BETWEEN DEPRESSION SYMPTOMS AND THE REWARD POSITIVITY IN YOUTH**

Brianna M. Lind, Jade N. Moros, Kathy Sem, Lilianne M. Gloe, Catherine E. Durbin, and Jason S. Moser  
Michigan State University

**Descriptors:** Reward Positivity, Depression, Youth  
Depression relates to reduced responsiveness to reward (RR) in studies of the reward positivity (RewP), a positive deflection of voltage measured via electroencephalogram (EEG) that occurs 250-350ms after positive feedback. In youth, several studies found that depression relates to a smaller RewP amplitude. However, no prior work considered age as a moderator of this association or included a sample with a wide age range spanning multiple developmental periods. Considering age as a moderator is critical given distinct theorized developmental trajectories of RR and depression. Therefore, we tested age as a hypothesized moderator of the association between depression symptoms and the RewP amplitude in 161 community youth ages four through 13 (M = 9.13 years, SD = 2.39). We hypothesized that depression symptoms would relate to a smaller RewP in older youth. In younger youth, analyses were exploratory given small and mixed evidence in youth under age 10. In contrast to our hypotheses, we found that age does not moderate the effect of depression symptoms on RewP amplitude (p > 0.05). Notably, age predicted a significantly smaller RewP difference wave (B = -0.51, SE = 0.223, p = 0.02). Our findings suggest that the RewP is unrelated to depression cross-sectionally. As suggested by prior research, the RewP may be a risk factor for depression in youth, such that it only acts as a predictor longitudinally. The importance of studying youth across a wide age range will be discussed.

**Funding:** The Michigan Longitudinal Study was funded by the National Institute on Drug Abuse (1R01DA03911201).

**Poster Session 3-069: Late-breaking Student Poster**

**INVESTIGATING THE CORRELATIONS BETWEEN RACE, NEIGHBORHOOD PERCEPTIONS AND HEART RATE VARIABILITY IN THE MIDUS STUDY**

Anthony Hill, Christina Li, and Leia Harper  
Reed College

**Descriptors:** Neighborhoods, Health Disparities, Cardiovascular Health  
A number of studies have examined the health disparities that exist between different racial groups within the United States. Specifically, they have found Black Americans (BA), compared to White Americans (WA), to have overall generally poorer cardiovascular health. Although personal determinants for these disparities are well documented in the literature, less is known about the possible mediating role of an individuals’ perception of their neighborhood environment, or neighborhood perceptions (NP), on cardiovascular metrics like heart rate variability (HRV) and risk factors like smoking. We examined the relationships between race, NP, HRV, and current smoking status using data from the Midlife in the United States Study, or MIDUS. Using a Pearson correlation coefficient we found negative correlations between NP and HRV in both the time and frequency domain. Univariate analysis showed that BAs had significantly lower NP (LNP) scores when compared to WAs. However, there were no significant correlations between NP and HRV in BA participants. WA participants had significantly lower HRV compared to racial minority participants for RMSSD (p = .015) and LF-HRV (p = .020). While both racial minority participants and participants with LNP were significantly more likely to smoke, race was not a significant moderator of the relationship between smoking and LNP. Future research should consider the effects of NP on risk behaviors like smoking in population disparities.

**Poster Session 3-070: Late-breaking Student Poster**

**COGNITIVE WORRY IS ASSOCIATED WITH DECREASED NEURAL EFFICIENCY DURING EMOTIONAL REGULATION**

Julia Gaumond, James Glazer, and Robin Nusslock  
Northwestern University

**Descriptors:** Worry, Cognitive Efficiency  
Anxiety and depression, common and often comorbid disorders, are both characterized by abnormal emotional processing. For this, they are often treated with practices such as reappraisal, a cognitive strategy for emotional regulation. However, both disorders share symptoms of worry, which has been associated with decreased neural efficiency during cognitive tasks. Despite the possibility of worrisome thoughts interfering with reappraisal, the interaction between the two has not been investigated. Therefore, this study examined the effect of worry on a positive event-related potential (ERP) reflecting both cognitive and emotional processing during reappraisal: the Late Positive Potential (LPP). 63 participants completed the Emotional Regulation Task (ERT) while electroencephalogram (EEG) activity was recorded. Participants were shown negative images for 7 seconds. On each trial, an audio cue instructed participants to “maintain” their natural emotional response or “reappraise” the image into something more positive. Worry was significantly correlated with an elevated LPP difference wave in the “maintain” condition (r = 0.272, p = 0.031). Results indicate that worry is associated with decreased neural efficiency during reappraisal; thus, worry may interfere with reappraisal due to competing demands on cognitive resources. Therefore, cognitive emotion regulation strategies may not be the most efficient treatment approaches for those with increased worry. Further implications and promising future directions are discussed.

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**Poster Session 3-071: Late-breaking Student Poster**

**A HISTORY OF CHILDHOOD TRAUMA IS ASSOCIATED WITH BLUNTED NEURAL RESPONSES TO POSITIVE SOCIAL FEEDBACK IN ADULT WOMEN**

Joelle Schaffer, Seonwoo Hong, Clara Freeman, Hélène Renault, Lidia Panier, and Anna Weinberg  
McGill University

**Descriptors:** Childhood trauma, Event-related potentials, Internalizing symptoms  
Traumatic experiences in childhood can have lasting influence on neural development and are often associated with internalizing symptoms in adulthood. However, it is unclear how childhood trauma results in internalizing symptoms, making the identification of pathways from adverse experiences to psychopathology critical. One potential pathway involves alterations in neural processing of social information. These alterations are often associated with social dysfunction as well as internalizing symptoms. This study explores associations between retrospective reports of childhood trauma, neural responses to social feedback, and current internalizing symptoms in a sample of 146 adult women (ages 18-58). Participants played a computerized interactive game in which they received peer acceptance and rejection feedback while electroencephalogram was recorded. The reward positivity (RewP) and P2, event-related potentials sensitive to positive feedback, were analyzed. Results indicate that childhood trauma is associated with a smaller RewP and P2 to peer acceptance. Additionally, a smaller RewP and P2 predict current symptoms of dysphoria, even adjusting for associations with childhood trauma. These findings suggest one potential path by which childhood trauma can lead to psychopathology is through blunted neural responses to social acceptance, which might ultimately contribute to dysphoria. Future research should explore a prospective model in which blunted neural responses to social acceptance may mediate the impact of childhood trauma on adulthood internalizing symptoms.
NEURAL SENSITIVITY TO NEGATIVE REINFORCEMENT MODERATES THE INFLUENCE OF ANXIETY SENSITIVITY ON ALCOHOL USE COPING MOTIVES

Dorothy Elizabeth Dreelin, John Elmer, Lauren Danzey, Hailey Fox, and Brian Albanese
Auburn University

*Descriptors:* RewP, reward, negative reinforcement

Problematic alcohol use is one of the leading causes of preventable death in the United States. Negatively reinforced drinking motives such as drinking to cope with negative emotions are more likely to lead to alcohol use problems, underscoring the need to understand why some individuals are more prone to using alcohol as a coping strategy. There is some research that shows that greater anxiety sensitivity (AS) is associated with greater alcohol use coping motives, though this evidence is mixed. The present work examines one explanation for these inconsistent findings, which is that AS only promotes negative reinforcement (NR)-driven alcohol use coping motives among those who are sensitive to NR. Participants (n = 168) completed self-report measures of AS, alcohol use motives, alcohol use, and posttraumatic stress symptoms prior to completing a modified doors task with NR (i.e., avoiding a noise blast vs. hearing a noise blast) and positive reinforcement (PR; i.e., winning vs. losing money) conditions while electrocortical data were recorded. The reward positivity (RewP) was extracted in both conditions. A significant interaction emerged between AS and the NR-RewP, but not the PR-RewP, such that elevated AS only predicted greater coping motives among people with a larger NR-RewP. Enhanced sensitivity to NR feedback may serve as a necessary but insufficient risk factor for NR-driven alcohol use coping motives. Future research should clarify if a greater NR-RewP serves as a necessary but insufficient risk factor for coping motives for alcohol and other substance use.

NEIGHBORHOOD PERCEPTIONS AND SLEEP AS A CONTRIBUTOR TO RACIAL DIFFERENCES IN HEART RATE VARIABILITY

Christina Xue LI
Reed College

*Descriptors:* cardiovascular risk, racial or ethnic minority

Psychophysiology research has exposed the health outcome disparities experienced between racial groups in the United States. Cardiovascular disease, the leading cause of death in the United States, disproportionately affects racial and ethnic minority groups in comparison to white Americans. Additionally, insufficient and disrupted sleep is linked with cardiovascular and metabolic dysregulation and morbidity; racial and ethnic minorities are generally more likely to experience poorer sleep quality and its resulting consequences on general health. The current study uses data from the MIDUS to examine the relationship between sleep quality and neighborhood perception (NP) as a contributor to cardiovascular health disparities, as indexed by heart rate variability (HRV), between racial minority (RM) and white/European American (EA) participants. For all participants, NP significantly predicted Pittsburgh Sleep Quality Index (PSQI) questionnaire scores (β = -.076, p < .001). Sequential regression was employed to determine if the addition of race and HRV time (SDRR, RMSSD) and frequency (HF-HRV, LF-HRV) domains significantly improved the model, (R² = .018; ΔR² = .016, ΔF = 8.84, p < .001), race was not a moderator of the relationship between NP and PSQI scores. Future research should continue to examine whether these associations are observed in more diverse and representative populations.
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